Development of Some New Hybrid Structures of Hypersoft Set with Possibility-degree Settings

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Abstract

The concept of a hypersoft membership function is introduced in the extension of a soft set known as a hypersoft set, permitting it to handle complicated and uncertain information in a more powerful and flexible manner. Many academics have already become fascinated with this new area of study, leading to the development of a number of hybrid structures. This chapter develops some new hybrid hypersoft set structures by taking into account multiple fuzzy set-like settings and possibility degree-based settings collectively. Additionally, numerical examples are included to clarify the concept of these structures. Researchers can utilize this work to better understand and apply a variety of mathematical ideas.

Keywords: Fuzzy Set, Intuitionistic Fuzzy Set, Neutrosophic Set, Soft Set, Hypersoft Set, Possibility Theory, Uncertainty, Attribute-valued Sets

1. Introduction

While analyzing information-based data, the data analyst has to cope with various kinds of uncertainties. Without a doubt, it is a challenging task in all respects. The ideas [1-3] are considered trustworthy regarding the handling of such uncertainties and impreciseness. However, it is observed that these ideas are unable to manage situations where attributes/parameters have to be considered. Therefore, Molodtsov [4] put forward the idea of the soft set (SOS) that is meant to equip the fuzzy set-like structures with parameterization mode. In SOS, the classical belonging mapping is replaced with approximate mapping that considers the set of parameters as its domain and the power set of initial space of alternatives as its co-domain. In other words, the SOS provides a single argument domain to approximate the alternatives. However, the SOS itself is inadequate with the settings which demand a multi-argument domain for the approximation of alternatives. Smarandache [5] addressed this issue by putting forward the idea of the hypersoft set (HypSOS) that employs MaaM to provide a multi-argument domain. This domain is obtained by taking the product of attribute-valued sub-classes. Saeed et al. [6] characterized various fundamental concepts and notions of HypSOS to enhance its applicability in other branches of study. Yolcu & Öztürk [7], Debnath [8], Ihsan et al. [9], Khan et al. [10], and Kamacı & Saqlain [11] developed the hybrid structures of HypSOS with fuzzy set-like environments and discussed their applications. Yolcu et al. [12] developed the hybrid structure of HypSOS with an intuitionistic fuzzy set and discussed its applications.

Zadeh [13] discussed the possibility theory as a basis for the fuzzy set. In such a theory, a possibility grade is used that is meant to assess the acceptance level of any approximation. Several authors [14-24] have already used possibility setting with soft set-like environments to develop various possibility SOS-like structures. Recently such settings have been employed with HypSOS-like environments to introduce new structures [25-31].

This chapter basically is aimed to extend the above-mentioned possibility SOS-like and HypSOS-like structures and then to introduce different types of possibility HypSOS-like structures.

Table 1: Notations and Abbreviations

Notations	Full Name	Notations	Full Name
$\mathfrak{A}^{F}$	Collection of fuzzy subsets	$\mathfrak{A}^{IVIF}$	Collection of interval-valued Intuitionistic fuzzy subsets
$\mathfrak{A}^{IF}$	Collection of intuitionistic fuzzy subsets	$\mathfrak{A}^{IVPF}$	Collection of interval-valued picture fuzzy subsets
$\mathfrak{A}^{PyF}$	Collection of Pythagorean fuzzy subsets	$\mathfrak{A}^{IVsvN}$	Collection of interval-valued sv-neutrosophic subsets
$\mathfrak{A}^{PF}$	Collection of picture fuzzy subsets	$\mathfrak{A}^{IVF}$	Collection of interval-valued fuzzy subsets
$\mathfrak{A}^{svN}$	Collection of sv-neutrosophic subsets	MaaM	Multi-argument approximate mapping

2. Preliminaries

This part presents some essential terms for proper understanding of the main results. The notation $2^{\hat{U}}$ represents the power set of $\hat{U}$ (initial space of objects).

Definition 2.1: Soft Set [1]

A SOS A is the collection of object $(\Psi_A, \hat{E})$ characterized by an approximate mapping $\Psi_A : \hat{E} \to 2^{\hat{U}}$ and defined as $A = \left\{ \left(\Psi_A(e), e \right) : e \in \hat{E} \wedge \Psi_A(e) \subseteq 2^{\hat{U}} \right\}$ where $\Psi_A(e)$ is *e*-approximate element of A corresponding to attribute *e* and $\hat{E}$ is the set of distinct attributes.

Definition 2.2: Hypersoft Set [5]

A HypSS H is the collection of object $(\Psi_H, \hat{\Theta})$ characterized by an approximate mapping $\Psi_H : \hat{\Theta} \to 2^{\hat{U}}$ and defined as $H = \left\{ \left(\Psi_H(\hat{\theta}), \hat{\theta} \right) : \hat{\theta} \in \hat{\Theta} \wedge \Psi_H(\hat{\theta}) \subseteq 2^{\hat{U}} \right\}$ where $\Psi_H(\hat{\theta})$ is $\hat{\theta}-$ approximate element of H corresponding to attribute-valued tuple $\wp$ and $\hat{\Theta} = \hat{\Theta}_1 \times \hat{\Theta}_2 \times \ldots \times \hat{\Theta}_n$. The sets $\hat{\Theta}_1, \hat{\Theta}_2, \ldots, \hat{\Theta}_n$ are attribute-valued non-overlapping sets.

3. Hybrid Structures of Hypersoft Sets

In this section, some new hybrid structures of hypersoft set are discussed with illustrative examples.

3.1 Hybrid Structures of Fuzzy Hypersoft Sets with Possibility Settings

In accessible literature, Rahman et al. [25-29], Zhao et al. [30] and Al-Hijjawi & Alkhazaleh [31] developed hybrid structures of hypersoft set by considering possibility degree in terms of fuzzy membership grades. However, in this section, possibility degree is considered in terms of other fuzzy set-like membership grades, e.g., intuitionistic fuzzy membership grades, neutrosophic membership grades, etc. The set $\hat{\Theta} = \hat{\Theta}_1 \times \hat{\Theta}_2 \times \ldots \times \hat{\Theta}_n$ is the product of attribute-valued disjoint sets $\hat{\Theta}_i, i = 1, 2, 3, \ldots, n$ with respect to *n* different attributes in

Definition 3.1.1: **Possibility Fuzzy Hypersoft Set of Type-1**

A possibility fuzzy hypersoft set of type-1 $\mathfrak{F}_1$ is defined as

$$\mathfrak{T}_1 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_F(\hat{\theta})(\hat{u})}, \mu_F(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_F(\hat{\theta})(\hat{u}), \mu_F(\hat{\theta}) \subseteq \mathfrak{A}^F$ and $\psi_F(\hat{\theta})(\hat{u}), \mu_F(\hat{\theta}) \in [0,1]$.

Example 3.1.1: Let $\hat{U} = \{\hat{u}_1, \hat{u}_2, \hat{u}_3, \hat{u}_4\}$ consisting of four models of air coolers and $\hat{\Theta} = \{\hat{\theta}_1, \hat{\theta}_2, \hat{\theta}_3, \hat{\theta}_4\}$ corresponding to attribute-valued sets $\hat{\Theta}_1 = \{800, 1000\}$, $\hat{\Theta}_2 = \{180, 230\}$, $\hat{\Theta}_3 = \{55\}$, and $\hat{\Theta}_4 = \{200\}$ with respect to attributes $\wp_1$ = water tank capacity in liters, $\wp_2$ = voltage, $\wp_3$ = air pressure in feet, and $\wp_4$ = weight in kilograms respectively then possibility fuzzy hypersoft set of type-1 $\mathfrak{T}_1$ can be constructed as

$$\mathfrak{T}_1 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{0.21}, 0.31 \right\rangle, \left\langle \frac{\hat{u}_2}{0.31}, 0.41 \right\rangle, \left\langle \frac{\hat{u}_3}{0.41}, 0.51 \right\rangle, \left\langle \frac{\hat{u}_4}{0.51}, 0.61 \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{0.22}, 0.32 \right\rangle, \left\langle \frac{\hat{u}_2}{0.32}, 0.42 \right\rangle, \left\langle \frac{\hat{u}_3}{0.42}, 0.52 \right\rangle, \left\langle \frac{\hat{u}_4}{0.52}, 0.62 \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{0.23}, 0.33 \right\rangle, \left\langle \frac{\hat{u}_2}{0.33}, 0.43 \right\rangle, \left\langle \frac{\hat{u}_3}{0.43}, 0.53 \right\rangle, \left\langle \frac{\hat{u}_4}{0.53}, 0.63 \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{0.24}, 0.34 \right\rangle, \left\langle \frac{\hat{u}_2}{0.34}, 0.44 \right\rangle, \left\langle \frac{\hat{u}_3}{0.44}, 0.54 \right\rangle, \left\langle \frac{\hat{u}_4}{0.54}, 0.64 \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.1.2: **Possibility Fuzzy Hypersoft Set of Type-2**

A possibility fuzzy hypersoft set of type-2 $\mathfrak{T}_2$ is defined as

$$\mathfrak{T}_1 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_F(\hat{\theta})(\hat{u})}, \mu_{IF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_F(\hat{\theta})(\hat{u}) \subseteq \mathfrak{A}^F$, $\mu_{IF}(\hat{\theta}) \subseteq \mathfrak{A}^{IF}$ and $\psi_F(\hat{\theta})(\hat{u}) \in [0,1]$, $\mu_{IF}(\hat{\theta}) = \left\langle T_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \right\rangle$ with $T_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \in [0,1]$ and $0 \le T_\mu(\hat{\theta}) + \mathrm{F}_\mu(\hat{\theta}) \le 1$.

Example 3.1.2: Considering the assumptions from Example 3.1.1, we can construct possibility fuzzy hypersoft set of type-2 $\mathfrak{T}_2$ can be constructed as

$\mathfrak{Z}_2 =$

$$\left\{\begin{array}{l}\left(\hat{\theta}_1,\left\{\left\langle\frac{\hat{u}_1}{0.21},\langle 0.31,0.21\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{0.31},\langle 0.41,0.31\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{0.41},\langle 0.51,0.41\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{0.51},\langle 0.61,0.21\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_2,\left\{\left\langle\frac{\hat{u}_1}{0.22},\langle 0.32,0.22\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{0.32},\langle 0.42,0.32\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{0.42},\langle 0.52,0.42\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{0.52},\langle 0.62,0.22\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_3,\left\{\left\langle\frac{\hat{u}_1}{0.23},\langle 0.33,0.23\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{0.33},\langle 0.43,0.33\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{0.43},\langle 0.53,0.43\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{0.53},\langle 0.63,0.23\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_4,\left\{\left\langle\frac{\hat{u}_1}{0.24},\langle 0.34,0.24\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{0.34},\langle 0.44,0.34\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{0.44},\langle 0.54,0.44\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{0.54},\langle 0.64,0.24\rangle\right\rangle\right\}\right),\end{array}\right\}.$$

Definition 3.1.3: **Possibility Fuzzy Hypersoft Set of Type-3**

A possibility fuzzy hypersoft set of type-3 $\mathfrak{Z}_3$ is defined as

$$\mathfrak{Z}_3 = \left\{\left(\hat{\theta},\left\langle\frac{\hat{u}}{\psi_F(\hat{\theta})(\hat{u})},\mu_{PyF}(\hat{\theta})\right\rangle\right):\hat{u}\in\hat{U}\wedge\hat{\theta}\in\hat{\Theta}\right\}$$

where $\psi_F(\hat{\theta})(\hat{u})\subseteq\mathfrak{A}^F$, $\mu_{PyF}(\hat{\theta})\subseteq\mathfrak{A}^{PyF}$ and $\psi_F(\hat{\theta})(\hat{u})\in[0,1]$, $\mu_{PyF}(\hat{\theta})=\left\langle T_\mu(\hat{\theta}),\mathrm{F}_\mu(\hat{\theta})\right\rangle$ with $T_\mu(\hat{\theta}),\mathrm{F}_\mu(\hat{\theta})\in[0,1]$ and $0\le T_\mu^2(\hat{\theta})+\mathrm{F}_\mu^2(\hat{\theta})\le 1$.

Example 3.1.3: Considering the assumptions from Example 3.1.1, we can construct possibility fuzzy hypersoft set of type-3 $\mathfrak{Z}_3$ can be constructed as

$$\mathfrak{Z}_3 = \left\{\begin{array}{l}\left(\hat{\theta}_1,\left\{\left\langle\frac{\hat{u}_1}{0.21},\langle 0.5,0.6\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{0.31},\langle 0.7,0.5\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{0.41},\langle 0.5,0.8\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{0.51},\langle 0.6,0.5\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_2,\left\{\left\langle\frac{\hat{u}_1}{0.22},\langle 0.9,0.4\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{0.32},\langle 0.4,0.8\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{0.42},\langle 0.4,0.7\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{0.52},\langle 0.5,0.8\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_3,\left\{\left\langle\frac{\hat{u}_1}{0.23},\langle 0.7,0.5\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{0.33},\langle 0.8,0.5\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{0.43},\langle 0.6,0.5\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{0.53},\langle 0.5,0.6\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_4,\left\{\left\langle\frac{\hat{u}_1}{0.24},\langle 0.4,0.9\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{0.34},\langle 0.8,0.4\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{0.44},\langle 0.7,0.4\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{0.54},\langle 0.8,0.5\rangle\right\rangle\right\}\right),\end{array}\right\}.$$

Definition 3.1.4: **Possibility Fuzzy Hypersoft Set of Type-4**

A possibility fuzzy hypersoft set of type-4 $\mathfrak{F}_4$ is defined as

$$\mathfrak{F}_4 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_F(\hat{\theta})(\hat{u})}, \mu_{PF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_F(\hat{\theta})(\hat{u}) \subseteq \mathfrak{A}^F$, $\mu_{PF}(\hat{\theta}) \subseteq \mathfrak{A}^{PF}$ and $\psi_F(\hat{\theta})(\hat{u}) \in [0,1]$, $\mu_{PF}(\hat{\theta}) = \left\langle T_\mu(\hat{\theta}), \mathrm{I}_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \right\rangle$ with $T_\mu(\hat{\theta}), \mathrm{I}_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \in [0,1]$ and $0 \le T_\mu(\hat{\theta}) + I_\mu(\hat{\theta}) + \mathrm{F}_\mu(\hat{\theta}) \le 1$.

Example 3.1.4: Considering the assumptions from Example 3.1.1, we can construct possibility fuzzy hypersoft set of type-4 $\mathfrak{F}_4$ can be constructed as

$$\mathfrak{F}_4 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{.2}, \langle .5,.1,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{.3}, \langle .2,.5,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{.4}, \langle .4,.2,.3 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{.5}, \langle .6,.1,.2 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{.3}, \langle .1,.4,.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{.4}, \langle .3,.4,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{.5}, \langle .2,.3,.3 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{.6}, \langle .2,.4,.2 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{.4}, \langle .3,.5,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{.5}, \langle .2,.5,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{.6}, \langle .6,.2,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{.7}, \langle .5,.2,.2 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{.5}, \langle .4,.1,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{.6}, \langle .2,.2,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{.7}, \langle .7,.1,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{.8}, \langle .4,.2,.1 \rangle \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.1.5: **Possibility Fuzzy Hypersoft Set of Type-5**

A possibility fuzzy hypersoft set of type-5 $\mathfrak{F}_5$ is defined as

$$\mathfrak{F}_5 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_F(\hat{\theta})(\hat{u})}, \mu_{svN}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_F(\hat{\theta})(\hat{u}) \subseteq \mathfrak{A}^F$, $\mu_{svN}(\hat{\theta}) \subseteq \mathfrak{A}^{svN}$ and $\psi_F(\hat{\theta})(\hat{u}) \in [0,1]$, $\mu_{svN}(\hat{\theta}) = \left\langle T_\mu(\hat{\theta}), \mathrm{I}_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \right\rangle$ with $T_\mu(\hat{\theta}), \mathrm{I}_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \in [0,1]$ and $0 \le T_\mu(\hat{\theta}) + I_\mu(\hat{\theta}) + \mathrm{F}_\mu(\hat{\theta}) \le 3$.

Example 3.1.5: Considering the assumptions from Example 3.1.1, we can construct possibility fuzzy hypersoft set of type-5 $\mathfrak{F}_5$ can be constructed as

$$\zeta_5 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{.2}, \langle .5,.6,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{.3}, \langle .6,.7,.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{.4}, \langle .7,.8,.8 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{.5}, \langle .8,.9,.9 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{.3}, \langle .6,.5,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{.4}, \langle .7,.6,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{.5}, \langle .8,.7,.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{.6}, \langle .9,.8,.8 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{.4}, \langle .7,.6,.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{.5}, \langle .8,.7,.8 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{.6}, \langle .9,.8,.9 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{.7}, \langle .6,.5,.9 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{.5}, \langle .8,.7,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{.6}, \langle .9,.6,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{.7}, \langle .6,.7,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{.8}, \langle .6,.8,.8 \rangle \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.1.6: **Possibility Fuzzy Hypersoft Set of Type-6**

A possibility fuzzy hypersoft set of type-6 ζ_6 is defined as

$$\zeta_6 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_F(\hat{\theta})(\hat{u})}, \mu_{IVF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_F(\hat{\theta})(\hat{u}) \subseteq \mathfrak{A}^F, \mu_{IVF}(\hat{\theta}) \subseteq \mathfrak{A}^{IVF}$ and $\psi_F(\hat{\theta})(\hat{u}) \in [0,1], \mu_{IVF}(\hat{\theta}) = \left[L_\mu(\hat{\theta}), \mathrm{U}_\mu(\hat{\theta}) \right]$ with $L_\mu(\hat{\theta}), \mathrm{U}_\mu(\hat{\theta}) \in [0,1]$.

Example 3.1.6: Considering the assumptions from Example 3.1.1, we can construct possibility fuzzy hypersoft set of type-6 ζ_6 can be constructed as

$$\zeta_6 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{0.21}, [0.21, 0.31] \right\rangle, \left\langle \frac{\hat{u}_2}{0.31}, [0.31, 0.41] \right\rangle, \left\langle \frac{\hat{u}_3}{0.41}, [0.41, 0.51] \right\rangle, \left\langle \frac{\hat{u}_4}{0.51}, [0.21, 0.61] \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{0.22}, [0.22, 0.32] \right\rangle, \left\langle \frac{\hat{u}_2}{0.32}, [0.32, 0.42] \right\rangle, \left\langle \frac{\hat{u}_3}{0.42}, [0.42, 0.52] \right\rangle, \left\langle \frac{\hat{u}_4}{0.52}, [0.22, 0.62] \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{0.23}, [0.23, 0.33] \right\rangle, \left\langle \frac{\hat{u}_2}{0.33}, [0.33, 0.43] \right\rangle, \left\langle \frac{\hat{u}_3}{0.43}, [0.43, 0.53] \right\rangle, \left\langle \frac{\hat{u}_4}{0.53}, [0.23, 0.63] \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{0.24}, [0.24, 0.34] \right\rangle, \left\langle \frac{\hat{u}_2}{0.34}, [0.34, 0.44] \right\rangle, \left\langle \frac{\hat{u}_3}{0.44}, [0.44, 0.54] \right\rangle, \left\langle \frac{\hat{u}_4}{0.54}, [0.24, 0.64] \right\rangle \right\} \right), \end{array} \right\}.$$

3.2 Hybrid Structures of Intuitionistic Fuzzy Hypersoft Sets with Possibility Settings

Definition 3.2.1: **Possibility Intuitionistic Fuzzy Hypersoft Set of Type-1**

A possibility intuitionistic fuzzy hypersoft set of type-1 λ_1 is defined as

$$\lambda_1 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{IF}(\hat{\theta})(\hat{u})}, \mu_F(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{IF}(\hat{\theta})(\hat{u}) = \left\langle T_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{IF}$, $\mu_F(\hat{\theta}) \subseteq \mathfrak{A}^F$ and $\mathrm{T}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}), \mu_F(\hat{\theta}) \in [0,1]$ such that $0 \le \mathrm{T}_\psi(\hat{\theta})(\hat{u}) + F_\psi(\hat{\theta})(\hat{u}) \le 1$.

Example 3.2.1: Considering the assumptions from Example 3.1.1, we can construct possibility intuitionistic fuzzy hypersoft set of type-1 λ_1 can be constructed as

$$\lambda_1 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .2,.5 \rangle}, 0.31 \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .3,.6 \rangle}, 0.41 \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .4,.4 \rangle}, 0.51 \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .5,.2 \rangle}, 0.61 \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .2,.3 \rangle}, 0.32 \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .3,.4 \rangle}, 0.42 \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .4,.2 \rangle}, 0.52 \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .5,.1 \rangle}, 0.62 \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .2,.5 \rangle}, 0.33 \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .3,.3 \rangle}, 0.43 \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .4,.1 \rangle}, 0.53 \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .5,.2 \rangle}, 0.63 \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .2,.2 \rangle}, 0.34 \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .3,.5 \rangle}, 0.44 \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .4,.5 \rangle}, 0.54 \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .5,.3 \rangle}, 0.64 \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.2.2: **Possibility Intuitionistic Fuzzy Hypersoft Set of Type-2**

A possibility intuitionistic fuzzy hypersoft set of type-2 λ_2 is defined as

$$\lambda_2 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{IF}(\hat{\theta})(\hat{u})}, \mu_{IF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{IF}(\hat{\theta})(\hat{u}) = \left\langle T_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{IF}$, $\mu_{IF}(\hat{\theta}) \subseteq \mathfrak{A}^{IF}$ and $T_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \in [0,1], \mu_{IF}(\hat{\theta}) = \left\langle T_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \right\rangle, T_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \in [0,1]$ with $0 \le T_\psi(\hat{\theta})(\hat{u}) + \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \le 1$ and $0 \le T_\mu(\hat{\theta}) + \mathrm{F}_\mu(\hat{\theta}) \le 1$.

Example 3.2.2: Considering the assumptions from Example 3.1.1, we can construct possibility intuitionistic fuzzy hypersoft set of type-2 λ_2 can be constructed as

$$\lambda_2=\left\{\begin{array}{l}\left(\hat{\theta}_1,\left\{\left\langle\frac{\hat{u}_1}{\langle .2,.4\rangle},\langle 0.31,0.21\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .3,.4\rangle},\langle 0.41,0.31\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .4,.5\rangle},\langle 0.51,0.41\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .5,.2\rangle},\langle 0.61,0.21\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_2,\left\{\left\langle\frac{\hat{u}_1}{\langle .2,.3\rangle},\langle 0.32,0.22\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .3,.2\rangle},\langle 0.42,0.32\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .4,.4\rangle},\langle 0.52,0.42\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .5,.1\rangle},\langle 0.62,0.22\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_3,\left\{\left\langle\frac{\hat{u}_1}{\langle .1,.5\rangle},\langle 0.33,0.23\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .1,.4\rangle},\langle 0.43,0.33\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .5,.1\rangle},\langle 0.53,0.43\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .4,.2\rangle},\langle 0.63,0.23\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_4,\left\{\left\langle\frac{\hat{u}_1}{\langle .3,.3\rangle},\langle 0.34,0.24\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .3,.5\rangle},\langle 0.44,0.34\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .4,.5\rangle},\langle 0.54,0.44\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .5,.3\rangle},\langle 0.64,0.24\rangle\right\rangle\right\}\right),\end{array}\right\}$$

.

Definition 3.2.3: **Possibility Intuitionistic Fuzzy Hypersoft Set of Type-3**

A possibility intuitionistic fuzzy hypersoft set of type-3 λ_3 is defined as

$$\lambda_3=\left\{\left(\hat{\theta},\left\langle\frac{\hat{u}}{\psi_{IF}(\hat{\theta})(\hat{u})},\mu_{PyF}(\hat{\theta})\right\rangle\right):\hat{u}\in\hat{U}\wedge\hat{\theta}\in\hat{\Theta}\right\}$$

where $\psi_{IF}(\hat{\theta})(\hat{u})=\left\langle \mathrm{T}_{\psi}(\hat{\theta})(\hat{u}),\mathrm{F}_{\psi}(\hat{\theta})(\hat{u})\right\rangle\subseteq\mathfrak{A}^{IF}$, $\mu_{PyF}(\hat{\theta})\subseteq\mathfrak{A}^{PyF}$ and $\mathrm{T}_{\psi}(\hat{\theta})(\hat{u}),\mathrm{F}_{\psi}(\hat{\theta})(\hat{u})\in[0,1]$ with $0\le \mathrm{T}_{\psi}(\hat{\theta})(\hat{u})+F_{\psi}(\hat{\theta})(\hat{u})\le 1$ and $\mu_{PyF}(\hat{\theta})=\left\langle T_{\mu}(\hat{\theta}),\mathrm{F}_{\mu}(\hat{\theta})\right\rangle$ with $T_{\mu}(\hat{\theta}),\mathrm{F}_{\mu}(\hat{\theta})\in[0,1]$ and $0\le T_{\mu}^2(\hat{\theta})+\mathrm{F}_{\mu}^2(\hat{\theta})\le 1$.

Example 3.2.3: Considering the assumptions from Example 3.1.1, we can construct possibility intuitionistic fuzzy hypersoft set of type-3 λ_3 can be constructed as

$$\lambda_3=\left\{\begin{array}{l}\left(\hat{\theta}_1,\left\{\left\langle\frac{\hat{u}_1}{\langle .2,.1\rangle},\langle 0.5,0.6\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .2,.3\rangle},\langle 0.7,0.5\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .2,.4\rangle},\langle 0.5,0.8\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .2,.5\rangle},\langle 0.6,0.5\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_2,\left\{\left\langle\frac{\hat{u}_1}{\langle .3,.1\rangle},\langle 0.9,0.4\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .3,.2\rangle},\langle 0.4,0.8\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .3,.4\rangle},\langle 0.4,0.7\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .3,.5\rangle},\langle 0.5,0.8\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_3,\left\{\left\langle\frac{\hat{u}_1}{\langle .4,.1\rangle},\langle 0.7,0.5\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .4,.2\rangle},\langle 0.8,0.5\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .4,.3\rangle},\langle 0.6,0.5\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .4,.5\rangle},\langle 0.5,0.6\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_4,\left\{\left\langle\frac{\hat{u}_1}{\langle .5,.1\rangle},\langle 0.4,0.9\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .5,.2\rangle},\langle 0.8,0.4\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .5,.3\rangle},\langle 0.7,0.4\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .5,.4\rangle},\langle 0.8,0.5\rangle\right\rangle\right\}\right),\end{array}\right\}$$

.

Definition 3.2.4: **Possibility Intuitionistic Fuzzy Hypersoft Set of Type-4**

A possibility intuitionistic fuzzy hypersoft set of type-4 λ_4 is defined as

$$\lambda_4 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{IF}(\hat{\theta})(\hat{u})}, \mu_{PF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{IF}(\hat{\theta})(\hat{u}) = \left\langle \mathrm{T}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{IF}$, and $\mathrm{T}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \in [0,1]$ with $0 \le \mathrm{T}_\psi(\hat{\theta})(\hat{u}) + F_\psi(\hat{\theta})(\hat{u}) \le 1$. Similarly $\mu_{PF}(\hat{\theta}) \subseteq \mathfrak{A}^{PF}$, $\mu_{PF}(\hat{\theta}) = \left\langle T_\mu(\hat{\theta}), \mathrm{I}_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \right\rangle$ with $T_\mu(\hat{\theta}), \mathrm{I}_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \in [0,1]$ and $0 \le T_\mu(\hat{\theta}) + I_\mu(\hat{\theta}) + \mathrm{F}_\mu(\hat{\theta}) \le 1$.

Example 3.2.4: Considering the assumptions from Example 3.1.1, we can construct possibility intuitionistic fuzzy hypersoft set of type-4 λ_4 can be constructed as

$$\lambda_4 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .2,.1 \rangle}, \langle .5,.1,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .2,.3 \rangle}, \langle .2,.5,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .2,.4 \rangle}, \langle .4,.2,.3 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .2,.5 \rangle}, \langle .6,.1,.2 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .3,.1 \rangle}, \langle .1,.4,.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .3,.2 \rangle}, \langle .3,.4,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .3,.4 \rangle}, \langle .2,.3,.3 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .3,.5 \rangle}, \langle .2,.4,.2 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .4,.1 \rangle}, \langle .3,.5,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .4,.2 \rangle}, \langle .2,.5,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .4,.3 \rangle}, \langle .6,.2,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .4,.5 \rangle}, \langle .5,.2,.2 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .5,.1 \rangle}, \langle .4,.1,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .5,.2 \rangle}, \langle .2,.2,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .5,.3 \rangle}, \langle .7,.1,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .5,.4 \rangle}, \langle .4,.2,.1 \rangle \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.2.5: **Possibility Intuitionistic Fuzzy Hypersoft Set of Type-5**

A possibility intuitionistic fuzzy hypersoft set of type-5 λ_5 is defined as

$$\lambda_5 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{IF}(\hat{\theta})(\hat{u})}, \mu_{svN}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{IF}(\hat{\theta})(\hat{u}) = \left\langle \mathrm{T}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{IF}$, and $\mathrm{T}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \in [0,1]$ with $0 \le \mathrm{T}_\psi(\hat{\theta})(\hat{u}) + F_\psi(\hat{\theta})(\hat{u}) \le 1$. Similarly $\mu_{svN}(\hat{\theta}) \subseteq \mathfrak{A}^{svN}$, $\mu_{svN}(\hat{\theta}) = \left\langle T_\mu(\hat{\theta}), \mathrm{I}_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \right\rangle$ with $T_\mu(\hat{\theta}), \mathrm{I}_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \in [0,1]$ and $0 \le T_\mu(\hat{\theta}) + I_\mu(\hat{\theta}) + \mathrm{F}_\mu(\hat{\theta}) \le 3$.

Example 3.2.5: Considering the assumptions from Example 3.1.1, we can construct possibility intuitionistic fuzzy hypersoft set of type-5 λ_5 can be constructed as

$$\lambda_5 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .2,.1 \rangle}, \langle .5,.6,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .2,.3 \rangle}, \langle .6,.7,.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .2,.4 \rangle}, \langle .7,.8,.8 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .2,.5 \rangle}, \langle .8,.9,.9 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .3,.1 \rangle}, \langle .6,.5,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .3,.2 \rangle}, \langle .7,.6,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .3,.4 \rangle}, \langle .8,.7,.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .3,.5 \rangle}, \langle .9,.8,.8 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .4,.1 \rangle}, \langle .7,.6,.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .4,.2 \rangle}, \langle .8,.7,.8 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .4,.3 \rangle}, \langle .9,.8,.9 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .4,.5 \rangle}, \langle .6,.5,.9 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .5,.1 \rangle}, \langle .8,.7,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .5,.2 \rangle}, \langle .9,.6,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .5,.3 \rangle}, \langle .6,.7,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .5,.4 \rangle}, \langle .6,.8,.8 \rangle \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.2.6: **Possibility Intuitionistic Fuzzy Hypersoft Set of Type-6**

A possibility intuitionistic fuzzy hypersoft set of type-6 λ_6 is defined as

$$\lambda_6 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{IF}(\hat{\theta})(\hat{u})}, \mu_{IVF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{IF}(\hat{\theta})(\hat{u}) = \left\langle T_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{IF}$ and $T_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \in [0,1]$ such that $0 \le T_{\psi}(\hat{\theta})(\hat{u}) + F_{\psi}(\hat{\theta})(\hat{u}) \le 1$.Similarly $\mu_{IVF}(\hat{\theta}) \subseteq \mathfrak{A}^{IVF}$ with $\mu_{IVF}(\hat{\theta}) = \left[L_{\mu}(\hat{\theta}), \mathrm{U}_{\mu}(\hat{\theta}) \right]$ and $L_{\mu}(\hat{\theta}), \mathrm{U}_{\mu}(\hat{\theta}) \in [0,1]$.

Example 3.2.6: Considering the assumptions from Example 3.1.1, we can construct possibility intuitionistic fuzzy hypersoft set of type-6 λ_6 can be constructed as

$$\lambda_6=\left\{\begin{array}{l}\left(\hat{\theta}_1,\left\{\left\langle\frac{\hat{u}_1}{\langle .2,.1\rangle},[0.21,0.31]\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .2,.3\rangle},[0.31,0.41]\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .2,.4\rangle},[0.41,0.51]\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .2,.5\rangle},[0.21,0.61]\right\rangle\right\}\right),\\ \left(\hat{\theta}_2,\left\{\left\langle\frac{\hat{u}_1}{\langle .3,.1\rangle},[0.22,0.32]\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .3,.2\rangle},[0.32,0.42]\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .3,.4\rangle},[0.42,0.52]\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .3,.5\rangle},[0.22,0.62]\right\rangle\right\}\right),\\ \left(\hat{\theta}_3,\left\{\left\langle\frac{\hat{u}_1}{\langle .4,.1\rangle},[0.23,0.33]\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .4,.2\rangle},[0.33,0.43]\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .4,.3\rangle},[0.43,0.53]\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .4,.5\rangle},[0.23,0.63]\right\rangle\right\}\right),\\ \left(\hat{\theta}_4,\left\{\left\langle\frac{\hat{u}_1}{\langle .5,.1\rangle},[0.24,0.34]\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .5,.2\rangle},[0.34,0.44]\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .5,.3\rangle},[0.44,0.54]\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .5,.5\rangle},[0.24,0.64]\right\rangle\right\}\right),\end{array}\right\}$$

3.3 Hybrid Structures of Pythagorean Fuzzy Hypersoft Sets with Possibility Settings

Definition 3.3.1: **Possibility Pythagorean Fuzzy Hypersoft Set of Type-1**

A possibility Pythagorean fuzzy hypersoft set of type-1 η_1 is defined as

$$\eta_1=\left\{\left(\hat{\theta},\left\langle\frac{\hat{u}}{\psi_{PyF}(\hat{\theta})(\hat{u})},\mu_F(\hat{\theta})\right\rangle\right):\hat{u}\in\hat{U}\wedge\hat{\theta}\in\hat{\Theta}\right\}$$

where $\psi_{PyF}(\hat{\theta})(\hat{u})=\left\langle T_\psi(\hat{\theta})(\hat{u}),\mathrm{F}_\psi(\hat{\theta})(\hat{u})\right\rangle\subseteq\mathfrak{A}^{PyF}$ and $\mathrm{T}_\psi(\hat{\theta})(\hat{u}),\mathrm{F}_\psi(\hat{\theta})(\hat{u})\in[0,1]$ such that $0\le\mathrm{T}_\psi^2(\hat{\theta})(\hat{u})+F_\psi^2(\hat{\theta})(\hat{u})\le 1$. Similarly $\mu_F(\hat{\theta})\subseteq\mathfrak{A}^F$ with $\mu_F(\hat{\theta})\in[0,1]$.

Example 3.3.1: Considering the assumptions from Example 3.1.1, we can construct possibility Pythagorean fuzzy hypersoft set of type-1 η_1 can be constructed as

$$\eta_1=\left\{\begin{array}{l}\left(\hat{\theta}_1,\left\{\left\langle\frac{\hat{u}_1}{\langle .5,.6\rangle},0.31\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .5,.7\rangle},0.41\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .5,.8\rangle},0.51\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .5,.8\rangle},0.61\right\rangle\right\}\right),\\ \left(\hat{\theta}_2,\left\{\left\langle\frac{\hat{u}_1}{\langle .6,.5\rangle},0.32\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .6,.6\rangle},0.42\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .6,.7\rangle},0.52\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .6,.7\rangle},0.62\right\rangle\right\}\right),\\ \left(\hat{\theta}_3,\left\{\left\langle\frac{\hat{u}_1}{\langle .7,.5\rangle},0.33\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .7,.6\rangle},0.43\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .7,.7\rangle},0.53\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .7,.4\rangle},0.63\right\rangle\right\}\right),\\ \left(\hat{\theta}_4,\left\{\left\langle\frac{\hat{u}_1}{\langle .8,.5\rangle},0.34\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .8,.5\rangle},0.44\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .8,.4\rangle},0.54\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .8,.4\rangle},0.64\right\rangle\right\}\right),\end{array}\right\}.$$

Definition 3.3.2: **Possibility Pythagorean Fuzzy Hypersoft Set of Type-2**

A possibility Pythagorean fuzzy hypersoft set of type-2 η_2 is defined as

$$\eta_2 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{PyF}(\hat{\theta})(\hat{u})}, \mu_{IF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{PyF}(\hat{\theta})(\hat{u}) = \left\langle T_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{PyF}, \mu_{IF}(\hat{\theta}) \subseteq \mathfrak{A}^{IF}$ and $T_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \in [0,1], \mu_{IF}(\hat{\theta}) = \left\langle T_{\mu}(\hat{\theta}), \mathrm{F}_{\mu}(\hat{\theta}) \right\rangle, T_{\mu}(\hat{\theta}), \mathrm{F}_{\mu}(\hat{\theta}) \in [0,1]$ with $0 \le \mathrm{T}_{\psi}^2(\hat{\theta})(\hat{u}) + F_{\psi}^2(\hat{\theta})(\hat{u}) \le 1$ and $0 \le T_{\mu}(\hat{\theta}) + \mathrm{F}_{\mu}(\hat{\theta}) \le 1$.

Example 3.3.2: Considering the assumptions from Example 3.1.1, we can construct possibility Pythagorean fuzzy hypersoft set of type-2 η_2 can be constructed as

$$\eta_2 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .5,.6 \rangle}, \langle 0.31, 0.21 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .5,.7 \rangle}, \langle 0.41, 0.31 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .5,.8 \rangle}, \langle 0.51, 0.41 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .5,.8 \rangle}, \langle 0.61, 0.21 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .6,.5 \rangle}, \langle 0.32, 0.22 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .6,.6 \rangle}, \langle 0.42, 0.32 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .6,.7 \rangle}, \langle 0.52, 0.42 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .6,.7 \rangle}, \langle 0.62, 0.22 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .7,.5 \rangle}, \langle 0.33, 0.23 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .7,.6 \rangle}, \langle 0.43, 0.33 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .7,.7 \rangle}, \langle 0.53, 0.43 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .7,.4 \rangle}, \langle 0.63, 0.23 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .8,.5 \rangle}, \langle 0.34, 0.24 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .8,.5 \rangle}, \langle 0.44, 0.34 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .8,.4 \rangle}, \langle 0.54, 0.44 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .8,.4 \rangle}, \langle 0.64, 0.24 \rangle \right\rangle \right\} \right), \end{array} \right\}$$

.

Definition 3.3.3: **Possibility Pythagorean Fuzzy Hypersoft Set of Type-3**

A possibility Pythagorean fuzzy hypersoft set of type-3 η_3 is defined as

$$\eta_3 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{PyF}(\hat{\theta})(\hat{u})}, \mu_{PyF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{PyF}(\hat{\theta})(\hat{u}) = \left\langle \mathrm{T}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{PyF}, \mu_{PyF}(\hat{\theta}) \subseteq \mathfrak{A}^{PyF}$ and $\mathrm{T}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \in [0,1]$ with $0 \le \mathrm{T}_{\psi}^2(\hat{\theta})(\hat{u}) + F_{\psi}^2(\hat{\theta})(\hat{u}) \le 1$ and $\mu_{PyF}(\hat{\theta}) = \left\langle T_{\mu}(\hat{\theta}), \mathrm{F}_{\mu}(\hat{\theta}) \right\rangle$ with $T_{\mu}(\hat{\theta}), \mathrm{F}_{\mu}(\hat{\theta}) \in [0,1]$ and $0 \le T_{\mu}^2(\hat{\theta}) + \mathrm{F}_{\mu}^2(\hat{\theta}) \le 1$.

Example 3.3.3: Considering the assumptions from Example 3.1.1, we can construct possibility Pythagorean fuzzy hypersoft set of type-3 η_3 can be constructed as

$$\eta_3 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .5,.6 \rangle}, \langle 0.5, 0.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .5,.7 \rangle}, \langle 0.7, 0.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .5,.8 \rangle}, \langle 0.5, 0.8 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .5,.8 \rangle}, \langle 0.6, 0.5 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .6,.5 \rangle}, \langle 0.9, 0.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .6,.6 \rangle}, \langle 0.4, 0.8 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .6,.7 \rangle}, \langle 0.4, 0.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .6,.7 \rangle}, \langle 0.5, 0.8 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .7,.4 \rangle}, \langle 0.7, 0.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .7,.5 \rangle}, \langle 0.8, 0.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .7,.6 \rangle}, \langle 0.6, 0.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .7,.7 \rangle}, \langle 0.5, 0.6 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .8,.4 \rangle}, \langle 0.4, 0.9 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .8,.5 \rangle}, \langle 0.8, 0.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .8,.5 \rangle}, \langle 0.7, 0.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .8,.4 \rangle}, \langle 0.8, 0.5 \rangle \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.3.4: **Possibility Pythagorean Fuzzy Hypersoft Set of Type-4**

A possibility Pythagorean fuzzy hypersoft set of type-4 η_4 is defined as

$$\eta_4 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{PyF}(\hat{\theta})(\hat{u})}, \mu_{PF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{PyF}(\hat{\theta})(\hat{u}) = \left\langle \mathrm{T}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{PyF}$, and $\mathrm{T}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \in [0,1]$ with $0 \le \mathrm{T}_{\psi}^2(\hat{\theta})(\hat{u}) + F_{\psi}^2(\hat{\theta})(\hat{u}) \le 1$. Similarly $\mu_{PF}(\hat{\theta}) \subseteq \mathfrak{A}^{PF}$, $\mu_{PF}(\hat{\theta}) = \left\langle T_{\mu}(\hat{\theta}), \mathrm{I}_{\mu}(\hat{\theta}), \mathrm{F}_{\mu}(\hat{\theta}) \right\rangle$ with $T_{\mu}(\hat{\theta}), \mathrm{I}_{\mu}(\hat{\theta}), \mathrm{F}_{\mu}(\hat{\theta}) \in [0,1]$ and $0 \le T_{\mu}(\hat{\theta}) + I_{\mu}(\hat{\theta}) + \mathrm{F}_{\mu}(\hat{\theta}) \le 1$.

Example 3.3.4: Considering the assumptions from Example 3.1.1, we can construct possibility Pythagorean fuzzy hypersoft set of type-4 η_4 can be constructed as

$$\eta_4 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .5,.6 \rangle}, \langle .5,.1,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .5,.7 \rangle}, \langle .2,.5,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .5,.8 \rangle}, \langle .4,.2,.3 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .5,.8 \rangle}, \langle .6,.1,.2 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .6,.5 \rangle}, \langle .1,.4,.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .6,.6 \rangle}, \langle .3,.4,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .6,.7 \rangle}, \langle .2,.3,.3 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .6,.7 \rangle}, \langle .2,.4,.2 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .7,.4 \rangle}, \langle .3,.5,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .7,.5 \rangle}, \langle .2,.5,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .7,.6 \rangle}, \langle .6,.2,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .7,.7 \rangle}, \langle .5,.2,.2 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .8,.4 \rangle}, \langle .4,.1,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .8,.5 \rangle}, \langle .2,.2,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .8,.5 \rangle}, \langle .7,.1,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .8,.4 \rangle}, \langle .4,.2,.1 \rangle \right\rangle \right\} \right), \end{array} \right\}$$

.

Definition 3.3.5: **Possibility Pythagorean Fuzzy Hypersoft Set of Type-5**

A possibility Pythagorean fuzzy hypersoft set of type-5 η_5 is defined as

$$\eta_5 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{PyF}(\hat{\theta})(\hat{u})}, \mu_{svN}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{PyF}(\hat{\theta})(\hat{u}) = \left\langle \mathrm{T}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{PyF}$, and $\mathrm{T}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \in [0,1]$ with $0 \leq \mathrm{T}_\psi^2(\hat{\theta})(\hat{u}) + F_\psi^2(\hat{\theta})(\hat{u}) \leq 1$. Similarly $\mu_{svN}(\hat{\theta}) \subseteq \mathfrak{A}^{svN}$, $\mu_{svN}(\hat{\theta}) = \left\langle T_\mu(\hat{\theta}), \mathrm{I}_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \right\rangle$ with $T_\mu(\hat{\theta}), \mathrm{I}_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \in [0,1]$ and $0 \leq T_\mu(\hat{\theta}) + I_\mu(\hat{\theta}) + \mathrm{F}_\mu(\hat{\theta}) \leq 3$.

Example 3.3.5: Considering the assumptions from Example 3.1.1, we can construct possibility Pythagorean fuzzy hypersoft set of type-5 η_5 can be constructed as

$$\eta_5 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .5,.6\rangle}, \langle .5,.6,.6\rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .5,.7\rangle}, \langle .6,.7,.7\rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .5,.8\rangle}, \langle .7,.8,.8\rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .5,.8\rangle}, \langle .8,.9,.9\rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .6,.5\rangle}, \langle .6,.5,.5\rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .6,.6\rangle}, \langle .7,.6,.6\rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .6,.7\rangle}, \langle .8,.7,.7\rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .6,.7\rangle}, \langle .9,.8,.8\rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .7,.4\rangle}, \langle .7,.6,.7\rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .7,.5\rangle}, \langle .8,.7,.8\rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .7,.6\rangle}, \langle .9,.8,.9\rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .7,.7\rangle}, \langle .6,.5,.9\rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .8,.4\rangle}, \langle .8,.7,.6\rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .8,.4\rangle}, \langle .9,.6,.5\rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .8,.5\rangle}, \langle .6,.7,.5\rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .8,.5\rangle}, \langle .6,.8,.8\rangle \right\rangle \right\} \right), \end{array} \right\}$$

.

Definition 3.3.6: **Possibility Pythagorean Fuzzy Hypersoft Set of Type-6**

A possibility Pythagorean fuzzy hypersoft set of type-6 η_6 is defined as

$$\eta_6 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{PyF}(\hat{\theta})(\hat{u})}, \mu_{IVF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{PyF}(\hat{\theta})(\hat{u}) = \left\langle T_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{PyF}$ and $T_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \in [0,1]$ such that $0 \le \mathrm{T}_{\psi}^2(\hat{\theta})(\hat{u}) + F_{\psi}^2(\hat{\theta})(\hat{u}) \le 1$. Similarly $\mu_{IVF}(\hat{\theta}) \subseteq \mathfrak{A}^{IVF}$ with $\mu_{IVF}(\hat{\theta}) = \left[L_{\mu}(\hat{\theta}), \mathrm{U}_{\mu}(\hat{\theta}) \right]$ and $L_{\mu}(\hat{\theta}), \mathrm{U}_{\mu}(\hat{\theta}) \in [0,1]$.

Example 3.3.6: Considering the assumptions from Example 3.1.1, we can construct possibility Pythagorean fuzzy hypersoft set of type-6 η_6 can be constructed as

$$\eta_6 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .5,.6\rangle}, [0.21, 0.31] \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .5,.7\rangle}, [0.31, 0.41] \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .5,.8\rangle}, [0.41, 0.51] \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .5,.8\rangle}, [0.21, 0.61] \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .6,.5\rangle}, [0.22, 0.32] \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .6,.6\rangle}, [0.32, 0.42] \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .6,.7\rangle}, [0.42, 0.52] \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .6,.7\rangle}, [0.22, 0.62] \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .7,.4\rangle}, [0.23, 0.33] \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .7,.5\rangle}, [0.33, 0.43] \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .7,.6\rangle}, [0.43, 0.53] \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .7,.7\rangle}, [0.23, 0.63] \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .8,.4\rangle}, [0.24, 0.34] \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .8,.5\rangle}, [0.34, 0.44] \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .8,.4\rangle}, [0.44, 0.54] \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .8,.5\rangle}, [0.24, 0.64] \right\rangle \right\} \right), \end{array} \right\}$$

3.4 Hybrid Structures of Picture Fuzzy Hypersoft Sets with Possibility Settings

Definition 3.4.1: **Possibility Picture Fuzzy Hypersoft Set of Type-1**

A possibility picture fuzzy hypersoft set of type-1 δ_1 is defined as

$$\delta_1 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{PF}(\hat{\theta})(\hat{u})}, \mu_F(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{PF}(\hat{\theta})(\hat{u}) = \left\langle T_\psi(\hat{\theta})(\hat{u}), \mathrm{I}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{PF}$ and $\mathrm{T}_\psi(\hat{\theta})(\hat{u}), \mathrm{I}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \in [0,1]$ such that $0 \le \mathrm{T}_\psi(\hat{\theta})(\hat{u}) + I_\psi(\hat{\theta})(\hat{u}) + F_\psi(\hat{\theta})(\hat{u}) \le 1$. Similarly $\mu_F(\hat{\theta}) \subseteq \mathfrak{A}^F$ with $\mu_F(\hat{\theta}) \in [0,1]$.

Example 3.4.1: Considering the assumptions from Example 3.1.1, we can construct possibility picture fuzzy hypersoft set of type-1 λ_1 can be constructed as

$$\lambda_1 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .2,.5,.1 \rangle}, .3 \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .3,.5,.1 \rangle}, .4 \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .4,.4,.1 \rangle}, .5 \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .5,.2,.1 \rangle}, .6 \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .2,.3,.2 \rangle}, .2 \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .3,.4,.2 \rangle}, .3 \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .4,.2,.2 \rangle}, .4 \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .5,.1,.2 \rangle}, .5 \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .2,.5,.3 \rangle}, .1 \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .3,.3,.3 \rangle}, .2 \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .4,.1,.3 \rangle}, .3 \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .5,.2,.2 \rangle}, .4 \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .2,.2,.4 \rangle}, .5 \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .3,.5,.1 \rangle}, .6 \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .4,.4,.1 \rangle}, .7 \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .5,.3,.1 \rangle}, .8 \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.4.2: **Possibility Picture Fuzzy Hypersoft Set of Type-2**

A possibility picture fuzzy hypersoft set of type-2 δ_2 is defined as

$$\delta_2 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{PF}(\hat{\theta})(\hat{u})}, \mu_{IF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{PF}(\hat{\theta})(\hat{u}) = \left\langle T_\psi(\hat{\theta})(\hat{u}), \mathrm{I}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{PF}$ and $T_\psi(\hat{\theta})(\hat{u}), \mathrm{I}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \in [0,1]$, with $0 \le T_\psi(\hat{\theta})(\hat{u}) + I_\psi(\hat{\theta})(\hat{u}) + \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \le 1$. Similarly $\mu_{IF}(\hat{\theta}) \subseteq \mathfrak{A}^{IF}$, $\mu_{IF}(\hat{\theta}) = \left\langle T_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \right\rangle$ and $T_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \in [0,1]$ with $0 \le T_\mu(\hat{\theta}) + \mathrm{F}_\mu(\hat{\theta}) \le 1$.

Example 3.4.2: Considering the assumptions from Example 3.1.1, we can construct possibility picture fuzzy hypersoft set of type-2 δ_2 can be constructed as

$$\delta_2 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .2,.4,.1 \rangle}, \langle .3,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .3,.4,.1 \rangle}, \langle .4,.3 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .4,.4,.1 \rangle}, \langle .5,.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .5,.2,.1 \rangle}, \langle .6,.2 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .2,.3,.2 \rangle}, \langle .3,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .3,.2,.2 \rangle}, \langle .4,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .4,.4,.1 \rangle}, \langle .5,.3 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .5,.1,.2 \rangle}, \langle .6,.1 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .1,.5,.3 \rangle}, \langle .3,.3 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .1,.4,.3 \rangle}, \langle .3,.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .5,.1,.3 \rangle}, \langle .3,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .4,.2,.3 \rangle}, \langle .3,.6 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .3,.3,.3 \rangle}, \langle .3,.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .3,.5,.2 \rangle}, \langle .3,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .4,.4,.2 \rangle}, \langle .3,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .3,.3,.2 \rangle}, \langle .3,.3 \rangle \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.4.3: **Possibility Picture Fuzzy Hypersoft Set of Type-3**

A possibility picture fuzzy hypersoft set of type-3 δ_3 is defined as

$$\delta_3 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{PF}(\hat{\theta})(\hat{u})}, \mu_{PyF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{PF}(\hat{\theta})(\hat{u}) = \left\langle \mathrm{T}_\psi(\hat{\theta})(\hat{u}), \mathrm{I}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{PF}$ and $\mathrm{T}_\psi(\hat{\theta})(\hat{u}), \mathrm{I}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \in [0,1]$ with $0 \le \mathrm{T}_\psi(\hat{\theta})(\hat{u}) + I_\psi(\hat{\theta})(\hat{u}) + F_\psi(\hat{\theta})(\hat{u}) \le 1$. Similarly $\mu_{PyF}(\hat{\theta}) \subseteq \mathfrak{A}^{PyF}$ and $\mu_{PyF}(\hat{\theta}) = \left\langle T_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \right\rangle$ with $T_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \in [0,1]$ and $0 \le T_\mu^2(\hat{\theta}) + \mathrm{F}_\mu^2(\hat{\theta}) \le 1$.

Example 3.4.3: Considering the assumptions from Example 3.1.1, we can construct possibility picture fuzzy hypersoft set of type-3 δ_3 can be constructed as

$$\lambda_3=\left\{\begin{array}{l}\left(\hat{\theta}_1,\left\{\left\langle\frac{\hat{u}_1}{\langle .2,.1,.1\rangle},\langle .5,.6\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .2,.3,.1\rangle},\langle .7,.5\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .2,.4,.1\rangle},\langle .5,.8\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .2,.5,.1\rangle},\langle .6,.5\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_2,\left\{\left\langle\frac{\hat{u}_1}{\langle .3,.1,.2\rangle},\langle .9,.4\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .3,.2,.2\rangle},\langle .4,.8\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .3,.4,.2\rangle},\langle .4,.7\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .3,.5,.1\rangle},\langle .5,.8\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_3,\left\{\left\langle\frac{\hat{u}_1}{\langle .4,.1,.3\rangle},\langle .7,.5\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .4,.2,.3\rangle},\langle .8,.5\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .4,.3,.1\rangle},\langle .6,.5\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .4,.4,.1\rangle},\langle .5,.6\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_4,\left\{\left\langle\frac{\hat{u}_1}{\langle .5,.1,.2\rangle},\langle .4,.9\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .5,.2,.1\rangle},\langle .8,.4\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .5,.3,.1\rangle},\langle .7,.4\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .5,.2,.1\rangle},\langle .8,.5\rangle\right\rangle\right\}\right),\end{array}\right\}.$$

Definition 3.4.4: **Possibility Picture Fuzzy Hypersoft Set of Type-4**

A possibility picture fuzzy hypersoft set of type-4 δ_4 is defined as

$$\delta_4=\left\{\left(\hat{\theta},\left\langle\frac{\hat{u}}{\psi_{PF}(\hat{\theta})(\hat{u})},\mu_{PF}(\hat{\theta})\right\rangle\right):\hat{u}\in\hat{U}\wedge\hat{\theta}\in\hat{\Theta}\right\}$$

where $\psi_{PF}(\hat{\theta})(\hat{u})=\left\langle \mathrm{T}_\psi(\hat{\theta})(\hat{u}),\mathrm{I}_\psi(\hat{\theta})(\hat{u}),\mathrm{F}_\psi(\hat{\theta})(\hat{u})\right\rangle\subseteq\mathfrak{A}^{PF}$, and $\mathrm{T}_\psi(\hat{\theta})(\hat{u}),\mathrm{I}_\psi(\hat{\theta})(\hat{u}),\mathrm{F}_\psi(\hat{\theta})(\hat{u})\in[0,1]$ with $0\le\mathrm{T}_\psi(\hat{\theta})(\hat{u})+I_\psi(\hat{\theta})(\hat{u})+F_\psi(\hat{\theta})(\hat{u})\le 1$. Similarly $\mu_{PF}(\hat{\theta})\subseteq\mathfrak{A}^{PF}$, $\mu_{PF}(\hat{\theta})=\left\langle T_\mu(\hat{\theta}),\mathrm{I}_\mu(\hat{\theta}),\mathrm{F}_\mu(\hat{\theta})\right\rangle$ with $T_\mu(\hat{\theta}),\mathrm{I}_\mu(\hat{\theta}),\mathrm{F}_\mu(\hat{\theta})\in[0,1]$ and $0\le T_\mu(\hat{\theta})+I_\mu(\hat{\theta})+\mathrm{F}_\mu(\hat{\theta})\le 1$.

Example 3.4.4: Considering the assumptions from Example 3.1.1, we can construct possibility picture fuzzy hypersoft set of type-4 δ_4 can be constructed as

$$\delta_4=\left\{\begin{array}{l}\left(\hat{\theta}_1,\left\{\left\langle\frac{\hat{u}_1}{\langle .2,.1,.1\rangle},\langle .5,.1,.2\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .2,.3,.1\rangle},\langle .2,.5,.2\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .2,.4,.1\rangle},\langle .4,.2,.3\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .2,.5,.1\rangle},\langle .6,.1,.2\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_2,\left\{\left\langle\frac{\hat{u}_1}{\langle .3,.1,.2\rangle},\langle .1,.4,.4\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .3,.2,.2\rangle},\langle .3,.4,.1\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .3,.4,.2\rangle},\langle .2,.3,.3\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .3,.5,.1\rangle},\langle .2,.4,.2\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_3,\left\{\left\langle\frac{\hat{u}_1}{\langle .4,.1,.2\rangle},\langle .3,.5,.1\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .4,.2,.1\rangle},\langle .2,.5,.2\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .4,.3,.1\rangle},\langle .6,.2,.1\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .4,.4,.1\rangle},\langle .5,.2,.2\rangle\right\rangle\right\}\right),\\ \left(\hat{\theta}_4,\left\{\left\langle\frac{\hat{u}_1}{\langle .5,.1,.2\rangle},\langle .4,.1,.1\rangle\right\rangle,\left\langle\frac{\hat{u}_2}{\langle .5,.2,.1\rangle},\langle .2,.2,.2\rangle\right\rangle,\left\langle\frac{\hat{u}_3}{\langle .5,.3,.1\rangle},\langle .7,.1,.1\rangle\right\rangle,\left\langle\frac{\hat{u}_4}{\langle .2,.4,.1\rangle},\langle .4,.2,.1\rangle\right\rangle\right\}\right),\end{array}\right\}$$

.

Definition 3.4.5: **Possibility Picture Fuzzy Hypersoft Set of Type-5**

A possibility picture fuzzy hypersoft set of type-5 δ_5 is defined as

$$\delta_5 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{PF}(\hat{\theta})(\hat{u})}, \mu_{svN}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{PF}(\hat{\theta})(\hat{u}) = \left\langle \mathrm{T}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{I}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{PF}$, and $\mathrm{T}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{I}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \in [0,1]$ with $0 \leq \mathrm{T}_{\psi}(\hat{\theta})(\hat{u}) + I_{\psi}(\hat{\theta})(\hat{u}) + F_{\psi}(\hat{\theta})(\hat{u}) \leq 1$. Similarly $\mu_{svN}(\hat{\theta}) \subseteq \mathfrak{A}^{svN}$, $\mu_{svN}(\hat{\theta}) = \left\langle T_{\mu}(\hat{\theta}), \mathrm{I}_{\mu}(\hat{\theta}), \mathrm{F}_{\mu}(\hat{\theta}) \right\rangle$ with $T_{\mu}(\hat{\theta}), \mathrm{I}_{\mu}(\hat{\theta}), \mathrm{F}_{\mu}(\hat{\theta}) \in [0,1]$ and $0 \leq T_{\mu}(\hat{\theta}) + I_{\mu}(\hat{\theta}) + \mathrm{F}_{\mu}(\hat{\theta}) \leq 3$.

Example 3.4.5: Considering the assumptions from Example 3.1.1, we can construct possibility picture fuzzy hypersoft set of type-5 δ_5 can be constructed as

$$\delta_5 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .2,.1,.1 \rangle}, \langle .5,.6,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .2,.3,.1 \rangle}, \langle .6,.7,.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .2,.4,.1 \rangle}, \langle .7,.8,.8 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .2,.5,.1 \rangle}, \langle .8,.9,.9 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .3,.1,.2 \rangle}, \langle .6,.5,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .3,.2,.2 \rangle}, \langle .7,.6,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .3,.4,.2 \rangle}, \langle .8,.7,.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .3,.5,.1 \rangle}, \langle .9,.8,.8 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .4,.1,.3 \rangle}, \langle .7,.6,.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .4,.2,.3 \rangle}, \langle .8,.7,.8 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .4,.3,.2 \rangle}, \langle .9,.8,.9 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .4,.4,.1 \rangle}, \langle .6,.5,.9 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .5,.1,.2 \rangle}, \langle .8,.7,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .5,.2,.1 \rangle}, \langle .9,.6,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .5,.3,.1 \rangle}, \langle .6,.7,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .3,.4,.1 \rangle}, \langle .6,.8,.8 \rangle \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.4.6: **Possibility Picture Fuzzy Hypersoft Set of Type-6**

A possibility picture fuzzy hypersoft set of type-6 δ_6 is defined as

$$\delta_6 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{PF}(\hat{\theta})(\hat{u})}, \mu_{IVF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{PF}(\hat{\theta})(\hat{u}) = \left\langle T_{\psi}(\hat{\theta})(\hat{u}), \mathrm{I}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{PF}$ and $T_{\psi}(\hat{\theta})(\hat{u}), \mathrm{I}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \in [0,1]$ such that $0 \leq T_{\psi}(\hat{\theta})(\hat{u}) + \mathrm{I}_{\psi}(\hat{\theta})(\hat{u}) + F_{\psi}(\hat{\theta})(\hat{u}) \leq 1$.Similarly $\mu_{IVF}(\hat{\theta}) \subseteq \mathfrak{A}^{IVF}$ with $\mu_{IVF}(\hat{\theta}) = \left[L_{\mu}(\hat{\theta}), \mathrm{U}_{\mu}(\hat{\theta}) \right]$ and $L_{\mu}(\hat{\theta}), \mathrm{U}_{\mu}(\hat{\theta}) \in [0,1]$.

Example 3.4.6: Considering the assumptions from Example 3.1.1, we can construct possibility picture fuzzy hypersoft set of type-6 δ_6 can be constructed as

$$\delta_6 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .2,.1,.1 \rangle}, [.2,.3] \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .2,.3,.1 \rangle}, [.3,.4] \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .2,.4,.1 \rangle}, [.4,.5] \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .2,.5,.1 \rangle}, [.5,.6] \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .3,.1,.2 \rangle}, [.6,.7] \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .3,.2,.2 \rangle}, [.7,.8] \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .3,.4,.2 \rangle}, [.8,.9] \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .3,.5,.1 \rangle}, [.2,.4] \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .4,.1,.2 \rangle}, [.3,.5] \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .4,.2,.2 \rangle}, [.4,.6] \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .4,.3,.1 \rangle}, [.5,.7] \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .4,.4,.1 \rangle}, [.6,.8] \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .5,.1,.1 \rangle}, [.7,.9] \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .5,.2,.1 \rangle}, [.2,.5] \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .5,.3,.1 \rangle}, [.3,.6] \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .2,.4,.1 \rangle}, [.4,.7] \right\rangle \right\} \right), \end{array} \right\}$$

3.5 Hybrid Structures of sv-Neutrosophic Hypersoft Sets with Possibility Settings

Definition 3.5.1: **Possibility sv-Neutrosophic Fuzzy Hypersoft Set of Type-1**

A possibility sv-neutrosophic hypersoft set of type-1 ϖ_1 is defined as

$$\varpi_1 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{svN}(\hat{\theta})(\hat{u})}, \mu_F(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{svN}(\hat{\theta})(\hat{u}) = \left\langle T_\psi(\hat{\theta})(\hat{u}), \mathrm{I}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{svN}$ and $\mathrm{T}_\psi(\hat{\theta})(\hat{u}), \mathrm{I}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \in [0,1]$ such that $0 \le \mathrm{T}_\psi(\hat{\theta})(\hat{u}) + I_\psi(\hat{\theta})(\hat{u}) + F_\psi(\hat{\theta})(\hat{u}) \le 3$. Similarly $\mu_F(\hat{\theta}) \subseteq \mathfrak{A}^F$ with $\mu_F(\hat{\theta}) \in [0,1]$.

Example 3.5.1: Considering the assumptions from Example 3.1.1, we can construct possibility sv-neutrosophic hypersoft set of type-1 ϖ_1 can be constructed as

$$\varpi_1 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .8,.8,.9 \rangle}, .3 \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .8,.8,.8 \rangle}, .4 \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .8,.8,.7 \rangle}, .5 \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .8,.8,.6 \rangle}, .6 \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .7,.7,.9 \rangle}, .2 \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .7,.7,.8 \rangle}, .3 \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .7,.7,.7 \rangle}, .4 \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .7,.7,.6 \rangle}, .5 \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .6,.6,.9 \rangle}, .1 \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .6,.6,.8 \rangle}, .2 \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .6,.6,.7 \rangle}, .3 \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .6,.9,.6 \rangle}, .4 \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .9,.9,.8 \rangle}, .5 \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .9,.9,.7 \rangle}, .6 \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .9,.9,.6 \rangle}, .7 \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .9,.9,.5 \rangle}, .8 \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.5.2: **Possibility sv-Neutrosophic Hypersoft Set of Type-2**

A possibility sv-neutrosophic hypersoft set of type-2 ϖ_2 is defined as

$$\varpi_2 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{svN}(\hat{\theta})(\hat{u})}, \mu_{IF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{svN}(\hat{\theta})(\hat{u}) = \left\langle T_\psi(\hat{\theta})(\hat{u}), \mathrm{I}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{svN}$ and $T_\psi(\hat{\theta})(\hat{u}), \mathrm{I}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \in [0,1]$, with $0 \le T_\psi(\hat{\theta})(\hat{u}) + I_\psi(\hat{\theta})(\hat{u}) + \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \le 3$. Similarly $\mu_{IF}(\hat{\theta}) \subseteq \mathfrak{A}^{IF}$, $\mu_{IF}(\hat{\theta}) = \left\langle T_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \right\rangle$ and $T_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \in [0,1]$ with $0 \le T_\mu(\hat{\theta}) + \mathrm{F}_\mu(\hat{\theta}) \le 1$.

Example 3.5.2: Considering the assumptions from Example 3.1.1, we can construct possibility sv-neutrosophic hypersoft set of type-2 ϖ_2 can be constructed as

$$\varpi_2 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .8,.8,.9 \rangle}, \langle .3,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .8,.8,.8 \rangle}, \langle .4,.3 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .8,.8,.7 \rangle}, \langle .5,.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .8,.8,.6 \rangle}, \langle .6,.2 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .7,.7,.9 \rangle}, \langle .3,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .7,.7,.8 \rangle}, \langle .4,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .7,.7,.7 \rangle}, \langle .5,.3 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .7,.7,.6 \rangle}, \langle .6,.1 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .6,.6,.9 \rangle}, \langle .3,.3 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .6,.6,.8 \rangle}, \langle .3,.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .6,.6,.7 \rangle}, \langle .3,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .6,.9,.6 \rangle}, \langle .3,.6 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .9,.9,.8 \rangle}, \langle .3,.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .9,.9,.7 \rangle}, \langle .3,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .9,.9,.6 \rangle}, \langle .3,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .9,.9,.5 \rangle}, \langle .3,.3 \rangle \right\rangle \right\} \right), \end{array} \right\}$$

.

Definition 3.5.3: **Possibility sv-Neutrosophic Hypersoft Set of Type-3**

A possibility sv-neutrosophic hypersoft set of type-3 ϖ_3 is defined as

$$\varpi_3 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{svN}(\hat{\theta})(\hat{u})}, \mu_{PyF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{svN}(\hat{\theta})(\hat{u}) = \left\langle \mathrm{T}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{I}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{svN}$ and $\mathrm{T}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{I}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \in [0,1]$ with $0 \le \mathrm{T}_{\psi}(\hat{\theta})(\hat{u}) + I_{\psi}(\hat{\theta})(\hat{u}) + F_{\psi}(\hat{\theta})(\hat{u}) \le 3$. Similarly $\mu_{PyF}(\hat{\theta}) \subseteq \mathfrak{A}^{PyF}$ and $\mu_{PyF}(\hat{\theta}) = \left\langle T_{\mu}(\hat{\theta}), \mathrm{F}_{\mu}(\hat{\theta}) \right\rangle$ with $T_{\mu}(\hat{\theta}), \mathrm{F}_{\mu}(\hat{\theta}) \in [0,1]$ and $0 \le T_{\mu}^2(\hat{\theta}) + \mathrm{F}_{\mu}^2(\hat{\theta}) \le 1$.

Example 3.5.3: Considering the assumptions from Example 3.1.1, we can construct possibility sv-neutrosophic hypersoft set of type-3 ϖ_3 can be constructed as

$$\varpi_3 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .8,.8,.9 \rangle}, \langle .5,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .8,.8,.8 \rangle}, \langle .7,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .8,.8,.7 \rangle}, \langle .5,.8 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .8,.8,.6 \rangle}, \langle .6,.5 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .7,.7,.9 \rangle}, \langle .9,.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .7,.7,.8 \rangle}, \langle .4,.8 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .7,.7,.7 \rangle}, \langle .4,.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .7,.7,.6 \rangle}, \langle .5,.8 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .6,.6,.9 \rangle}, \langle .7,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .6,.6,.8 \rangle}, \langle .8,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .6,.6,.7 \rangle}, \langle .6,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .6,.9,.6 \rangle}, \langle .5,.6 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .9,.9,.8 \rangle}, \langle .4,.9 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .9,.9,.7 \rangle}, \langle .8,.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .9,.9,.6 \rangle}, \langle .7,.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .9,.9,.5 \rangle}, \langle .8,.5 \rangle \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.5.4: **Possibility sv-Neutrosophic Hypersoft Set of Type-4**

A possibility sv-neutrosophic hypersoft set of type-4 ϖ_4 is defined as

$$\varpi_4 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{svN}(\hat{\theta})(\hat{u})}, \mu_{PF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{svN}(\hat{\theta})(\hat{u}) = \left\langle \mathrm{T}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{I}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{svN}$ and $\mathrm{T}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{I}_{\psi}(\hat{\theta})(\hat{u}), \mathrm{F}_{\psi}(\hat{\theta})(\hat{u}) \in [0,1]$ with $0 \le \mathrm{T}_{\psi}(\hat{\theta})(\hat{u}) + I_{\psi}(\hat{\theta})(\hat{u}) + F_{\psi}(\hat{\theta})(\hat{u}) \le 3$. Similarly $\mu_{PF}(\hat{\theta}) \subseteq \mathfrak{A}^{PF}$, $\mu_{PF}(\hat{\theta}) = \left\langle T_{\mu}(\hat{\theta}), \mathrm{I}_{\mu}(\hat{\theta}), \mathrm{F}_{\mu}(\hat{\theta}) \right\rangle$ with $T_{\mu}(\hat{\theta}), \mathrm{I}_{\mu}(\hat{\theta}), \mathrm{F}_{\mu}(\hat{\theta}) \in [0,1]$ and $0 \le T_{\mu}(\hat{\theta}) + I_{\mu}(\hat{\theta}) + \mathrm{F}_{\mu}(\hat{\theta}) \le 1$.

Example 3.5.4: Considering the assumptions from Example 3.1.1, we can construct possibility sv-neutrosophic hypersoft set of type-4 ϖ_4 can be constructed as

$$\varpi_4 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .8,.8,.9 \rangle}, \langle .5,.1,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .8,.8,.8 \rangle}, \langle .2,.5,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .8,.8,.7 \rangle}, \langle .4,.2,.3 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .8,.8,.6 \rangle}, \langle .6,.1,.2 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .7,.7,.9 \rangle}, \langle .1,.4,.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .7,.7,.8 \rangle}, \langle .3,.4,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .7,.7,.7 \rangle}, \langle .2,.3,.3 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .7,.7,.6 \rangle}, \langle .2,.4,.2 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .6,.6,.9 \rangle}, \langle .3,.5,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .6,.6,.8 \rangle}, \langle .2,.5,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .6,.6,.7 \rangle}, \langle .6,.2,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .6,.9,.6 \rangle}, \langle .5,.2,.2 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .9,.9,.8 \rangle}, \langle .4,.1,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .9,.9,.7 \rangle}, \langle .2,.2,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .9,.9,.6 \rangle}, \langle .7,.1,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .9,.9,.5 \rangle}, \langle .4,.2,.1 \rangle \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.5.5: **Possibility sv-Neutrosophic Hypersoft Set of Type-5**

A possibility sv-neutrosophic hypersoft set of type-5 ϖ_5 is defined as

$$\varpi_5 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{svN}(\hat{\theta})(\hat{u})}, \mu_{svN}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{svN}(\hat{\theta})(\hat{u}) = \left\langle \mathrm{T}_\psi(\hat{\theta})(\hat{u}), \mathrm{I}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{svN}$ and $\mathrm{T}_\psi(\hat{\theta})(\hat{u}), \mathrm{I}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \in [0,1]$ with $0 \le \mathrm{T}_\psi(\hat{\theta})(\hat{u}) + I_\psi(\hat{\theta})(\hat{u}) + F_\psi(\hat{\theta})(\hat{u}) \le 3$. Similarly $\mu_{svN}(\hat{\theta}) \subseteq \mathfrak{A}^{svN}$, $\mu_{svN}(\hat{\theta}) = \left\langle T_\mu(\hat{\theta}), \mathrm{I}_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \right\rangle$ with $T_\mu(\hat{\theta}), \mathrm{I}_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \in [0,1]$ and $0 \le T_\mu(\hat{\theta}) + I_\mu(\hat{\theta}) + \mathrm{F}_\mu(\hat{\theta}) \le 3$.

Example 3.5.5: Considering the assumptions from Example 3.1.1, we can construct possibility sv-neutrosophic hypersoft set of type-5 ϖ_5 can be constructed as

$$\varpi_5 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .8,.8,.9 \rangle}, \langle .5,.6,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .8,.8,.8 \rangle}, \langle .6,.7,.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .8,.8,.7 \rangle}, \langle .7,.8,.8 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .8,.8,.6 \rangle}, \langle .8,.9,.9 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .7,.7,.9 \rangle}, \langle .6,.5,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .7,.7,.8 \rangle}, \langle .7,.6,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .7,.7,.7 \rangle}, \langle .8,.7,.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .7,.7,.6 \rangle}, \langle .9,.8,.8 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .6,.6,.9 \rangle}, \langle .7,.6,.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .6,.6,.8 \rangle}, \langle .8,.7,.8 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .6,.6,.7 \rangle}, \langle .9,.8,.9 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .6,.9,.6 \rangle}, \langle .6,.5,.9 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .9,.9,.8 \rangle}, \langle .8,.7,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .9,.9,.7 \rangle}, \langle .9,.6,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .9,.9,.6 \rangle}, \langle .6,.7,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .9,.9,.5 \rangle}, \langle .6,.8,.8 \rangle \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.5.6: **Possibility sv-Neutrosophic Hypersoft Set of Type-6**

A possibility sv-neutrosophic hypersoft set of type-6 ϖ_6 is defined as

$$\delta_6 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{PF}(\hat{\theta})(\hat{u})}, \mu_{IVF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{svN}(\hat{\theta})(\hat{u}) = \left\langle T_\psi(\hat{\theta})(\hat{u}), \mathrm{I}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \right\rangle \subseteq \mathfrak{A}^{svN}$ and $T_\psi(\hat{\theta})(\hat{u}), \mathrm{I}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \in [0,1]$ such that $0 \le T_\psi(\hat{\theta})(\hat{u}) + \mathrm{I}_\psi(\hat{\theta})(\hat{u}) + F_\psi(\hat{\theta})(\hat{u}) \le 3$. Similarly $\mu_{IVF}(\hat{\theta}) \subseteq \mathfrak{A}^{IVF}$ with $\mu_{IVF}(\hat{\theta}) = \left[L_\mu(\hat{\theta}), \mathrm{U}_\mu(\hat{\theta}) \right]$ and $L_\mu(\hat{\theta}), \mathrm{U}_\mu(\hat{\theta}) \in [0,1]$.

Example 3.5.6: Considering the assumptions from Example 3.1.1, we can construct possibility sv-neutrosophic hypersoft set of type-6 ϖ_6 can be constructed as

$$\varpi_6 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{\langle .8,.8,.9 \rangle}, [.2,.3] \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .8,.8,.8 \rangle}, [.3,.4] \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .8,.8,.7 \rangle}, [.4,.5] \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .8,.8,.6 \rangle}, [.5,.6] \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{\langle .7,.7,.9 \rangle}, [.6,.7] \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .7,.7,.8 \rangle}, [.7,.8] \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .7,.7,.7 \rangle}, [.8,.9] \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .7,.7,.6 \rangle}, [.2,.4] \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{\langle .6,.6,.9 \rangle}, [.3,.5] \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .6,.6,.8 \rangle}, [.4,.6] \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .6,.6,.7 \rangle}, [.5,.7] \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .6,.9,.6 \rangle}, [.6,.8] \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{\langle .9,.9,.8 \rangle}, [.7,.9] \right\rangle, \left\langle \frac{\hat{u}_2}{\langle .9,.9,.7 \rangle}, [.2,.5] \right\rangle, \left\langle \frac{\hat{u}_3}{\langle .9,.9,.6 \rangle}, [.3,.6] \right\rangle, \left\langle \frac{\hat{u}_4}{\langle .9,.9,.5 \rangle}, [.4,.7] \right\rangle \right\} \right), \end{array} \right\}$$

3.6 Hybrid Structures of Interval-valued Fuzzy Hypersoft Sets with Possibility Settings

Definition 3.6.1: **Possibility Interval-valued Fuzzy Hypersoft Set of Type-1**

A possibility interval-valued fuzzy hypersoft set of type-1 π_1 is defined as

$$\pi_1 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{IVF}(\hat{\theta})(\hat{u})}, \mu_F(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{IVF}(\hat{\theta})(\hat{u}) = \left[L_\psi(\hat{\theta})(\hat{u}), \mathrm{U}_\psi(\hat{\theta})(\hat{u}) \right] \subseteq \mathfrak{A}^{IVF}$ and $L_\psi(\hat{\theta})(\hat{u}), \mathrm{U}_\psi(\hat{\theta})(\hat{u}) \in [0,1]$. Similarly $\mu_F(\hat{\theta}) \subseteq \mathfrak{A}^F$ with $\mu_F(\hat{\theta}) \in [0,1]$.

Example 3.6.1: Considering the assumptions from Example 3.1.1, we can construct possibility interval-valued fuzzy hypersoft set of type-1 π_1 can be constructed as

$$\pi_1 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{[.2,.3]}, 0.31 \right\rangle, \left\langle \frac{\hat{u}_2}{[.2,.4]}, 0.41 \right\rangle, \left\langle \frac{\hat{u}_3}{[.2,.5]}, 0.51 \right\rangle, \left\langle \frac{\hat{u}_4}{[.2,.6]}, 0.61 \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{[.3,.4]}, 0.32 \right\rangle, \left\langle \frac{\hat{u}_2}{[.3,.5]}, 0.42 \right\rangle, \left\langle \frac{\hat{u}_3}{[.3,.6]}, 0.52 \right\rangle, \left\langle \frac{\hat{u}_4}{[.3,.7]}, 0.62 \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{[.4,.5]}, 0.33 \right\rangle, \left\langle \frac{\hat{u}_2}{[.4,.6]}, 0.43 \right\rangle, \left\langle \frac{\hat{u}_3}{[.4,.7]}, 0.53 \right\rangle, \left\langle \frac{\hat{u}_4}{[.4,.8]}, 0.63 \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{[.5,.6]}, 0.34 \right\rangle, \left\langle \frac{\hat{u}_2}{[.5,.7]}, 0.44 \right\rangle, \left\langle \frac{\hat{u}_3}{[.5,.8]}, 0.54 \right\rangle, \left\langle \frac{\hat{u}_4}{[.5,.9]}, 0.64 \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.6.2: **Possibility Interval-valued Fuzzy Hypersoft Set of Type-2**

A possibility interval-valued fuzzy hypersoft set of type-2 π_2 is defined as

$$\pi_2 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{IVF}(\hat{\theta})(\hat{u})}, \mu_{IF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{IVF}(\hat{\theta})(\hat{u}) = \left[L_\psi(\hat{\theta})(\hat{u}), \mathrm{U}_\psi(\hat{\theta})(\hat{u}) \right] \subseteq \mathfrak{A}^{IVF}$ and $L_\psi(\hat{\theta})(\hat{u}), \mathrm{U}_\psi(\hat{\theta})(\hat{u}) \in [0,1]$. Similarly $\mu_{IF}(\hat{\theta}) \subseteq \mathfrak{A}^{IF}$ with $\mu_{IF}(\hat{\theta}) = \left\langle T_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \right\rangle, T_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \in [0,1]$ such that $0 \le T_\mu(\hat{\theta}) + \mathrm{F}_\mu(\hat{\theta}) \le 1$.

Example 3.6.2: Considering the assumptions from Example 3.1.1, we can construct possibility interval-valued fuzzy hypersoft set of type-2 π_2 can be constructed as

$$\pi_2 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{[.2,.3]}, \langle .31,.21 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{[.2,.4]}, \langle .41,.31 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{[.2,.5]}, \langle .51,.41 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{[.2,.6]}, \langle .61,.21 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{[.3,.4]}, \langle .32,.22 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{[.3,.5]}, \langle .42,.32 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{[.3,.6]}, \langle .52,.42 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{[.3,.7]}, \langle .62,.22 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{[.4,.5]}, \langle .33,.23 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{[.4,.6]}, \langle .43,.33 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{[.4,.7]}, \langle .53,.43 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{[.4,.8]}, \langle .63,.23 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{[.5,.6]}, \langle .34,.24 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{[.5,.7]}, \langle .44,.34 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{[.5,.8]}, \langle .54,.44 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{[.5,.9]}, \langle .64,.24 \rangle \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.6.3: **Possibility Interval-valued Fuzzy Hypersoft Set of Type-3**

A possibility interval-valued fuzzy hypersoft set of type-3 π_3 is defined as

$$\pi_3 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{IVF}(\hat{\theta})(\hat{u})}, \mu_{PyF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{IVF}(\hat{\theta})(\hat{u}) = \left[L_\psi(\hat{\theta})(\hat{u}), \mathrm{U}_\psi(\hat{\theta})(\hat{u}) \right] \subseteq \mathfrak{A}^{IVF}$ and $\mathrm{T}_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \in [0,1]$. Similarly $\mu_{PyF}(\hat{\theta}) \subseteq \mathfrak{A}^{PyF}$ with $\mu_{PyF}(\hat{\theta}) = \left\langle T_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \right\rangle$, $T_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \in [0,1]$ and $0 \le T_\mu^2(\hat{\theta}) + \mathrm{F}_\mu^2(\hat{\theta}) \le 1$.

Example 3.6.3: Considering the assumptions from Example 3.1.1, we can construct possibility interval-valued fuzzy hypersoft set of type-3 π_3 can be constructed as

$$\pi_3 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{[.2,.3]}, \langle .5,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{[.2,.4]}, \langle .7,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{[.2,.5]}, \langle .5,.8 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{[.2,.6]}, \langle .6,.5 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{[.3,.4]}, \langle .9,.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{[.3,.5]}, \langle .4,.8 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{[.3,.6]}, \langle .4,.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{[.3,.7]}, \langle .5,.8 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{[.4,.5]}, \langle .7,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{[.4,.6]}, \langle .8,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{[.4,.7]}, \langle .6,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{[.4,.8]}, \langle .5,.6 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{[.5,.6]}, \langle .4,.9 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{[.5,.7]}, \langle .8,.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{[.5,.8]}, \langle .7,.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{[.5,.9]}, \langle .8,.5 \rangle \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.6.4: **Possibility Interval-valued Fuzzy Hypersoft Set of Type-4**

A possibility interval-valued fuzzy hypersoft set of type-4 π_4 is defined as

$$\pi_4 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{IVF}(\hat{\theta})(\hat{u})}, \mu_{PF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{IVF}(\hat{\theta})(\hat{u}) = \left[L_\psi(\hat{\theta})(\hat{u}), \mathrm{U}_\psi(\hat{\theta})(\hat{u}) \right] \subseteq \mathfrak{A}^{IVF}$, and $L_\psi(\hat{\theta})(\hat{u}), \mathrm{U}_\psi(\hat{\theta})(\hat{u}) \in [0,1]$. Similarly $\mu_{PF}(\hat{\theta}) \subseteq \mathfrak{A}^{PF}$, $\mu_{PF}(\hat{\theta}) = \left\langle T_\mu(\hat{\theta}), \mathrm{I}_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \right\rangle$ with $T_\mu(\hat{\theta}), \mathrm{I}_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \in [0,1]$ and $0 \le T_\mu(\hat{\theta}) + I_\mu(\hat{\theta}) + \mathrm{F}_\mu(\hat{\theta}) \le 1$.

Example 3.6.4: Considering the assumptions from Example 3.1.1, we can construct possibility interval-valued fuzzy hypersoft set of type-4 π_4 can be constructed as

$$\pi_4 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{[.2,.3]}, \langle .5,.1,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{[.2,.4]}, \langle .2,.5,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{[.2,.5]}, \langle .4,.2,.3 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{[.2,.6]}, \langle .6,.1,.2 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{[.3,.4]}, \langle .1,.4,.4 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{[.3,.5]}, \langle .3,.4,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{[.3,.6]}, \langle .2,.3,.3 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{[.3,.7]}, \langle .2,.4,.2 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{[.4,.5]}, \langle .3,.5,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{[.4,.6]}, \langle .2,.5,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{[.4,.7]}, \langle .6,.2,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{[.4,.8]}, \langle .5,.2,.2 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{[.5,.6]}, \langle .4,.1,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{[.5,.7]}, \langle .2,.2,.2 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{[.5,.8]}, \langle .7,.1,.1 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{[.5,.9]}, \langle .4,.2,.1 \rangle \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.6.5: **Possibility Interval-valued Fuzzy Hypersoft Set of Type-5**

A possibility interval-valued fuzzy hypersoft set of type-5 π_5 is defined as

$$\pi_5 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{IVF}(\hat{\theta})(\hat{u})}, \mu_{svN}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{IVF}(\hat{\theta})(\hat{u}) = \left[L_\psi(\hat{\theta})(\hat{u}), \mathrm{U}_\psi(\hat{\theta})(\hat{u}) \right] \subseteq \mathfrak{A}^{IVF}$, and $L_\psi(\hat{\theta})(\hat{u}), \mathrm{U}_\psi(\hat{\theta})(\hat{u}) \in [0,1]$. Similarly $\mu_{svN}(\hat{\theta}) \subseteq \mathfrak{A}^{svN}$, $\mu_{svN}(\hat{\theta}) = \left\langle T_\mu(\hat{\theta}), \mathrm{I}_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \right\rangle$ with $T_\mu(\hat{\theta}), \mathrm{I}_\mu(\hat{\theta}), \mathrm{F}_\mu(\hat{\theta}) \in [0,1]$ and $0 \le T_\mu(\hat{\theta}) + I_\mu(\hat{\theta}) + \mathrm{F}_\mu(\hat{\theta}) \le 3$.

Example 3.6.5: Considering the assumptions from Example 3.1.1, we can construct possibility interval-valued fuzzy hypersoft set of type-5 π_5 can be constructed as

$$\pi_5 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{[.2,.3]}, \langle .5,.6,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{[.2,.4]}, \langle .6,.7,.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{[.2,.5]}, \langle .7,.8,.8 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{[.2,.6]}, \langle .8,.9,.9 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{[.3,.4]}, \langle .6,.5,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{[.3,.5]}, \langle .7,.6,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{[.3,.6]}, \langle .8,.7,.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{[.3,.7]}, \langle .9,.8,.8 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{[.4,.5]}, \langle .7,.6,.7 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{[.4,.6]}, \langle .8,.7,.8 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{[.4,.7]}, \langle .9,.8,.9 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{[.4,.8]}, \langle .6,.5,.9 \rangle \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{[.5,.6]}, \langle .8,.7,.6 \rangle \right\rangle, \left\langle \frac{\hat{u}_2}{[.5,.7]}, \langle .9,.6,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_3}{[.5,.8]}, \langle .6,.7,.5 \rangle \right\rangle, \left\langle \frac{\hat{u}_4}{[.5,.9]}, \langle .6,.8,.8 \rangle \right\rangle \right\} \right), \end{array} \right\}.$$

Definition 3.6.6: **Possibility Interval-valued Fuzzy Hypersoft Set of Type-6**

A possibility interval-valued fuzzy hypersoft set of type-6 π_6 is defined as

$$\pi_6 = \left\{ \left(\hat{\theta}, \left\langle \frac{\hat{u}}{\psi_{IVF}(\hat{\theta})(\hat{u})}, \mu_{IVF}(\hat{\theta}) \right\rangle \right) : \hat{u} \in \hat{U} \wedge \hat{\theta} \in \hat{\Theta} \right\}$$

where $\psi_{IVF}(\hat{\theta})(\hat{u}) = \left[L_\psi(\hat{\theta})(\hat{u}), \mathrm{U}_\psi(\hat{\theta})(\hat{u}) \right] \subseteq \mathfrak{A}^{IVF}$ and $T_\psi(\hat{\theta})(\hat{u}), \mathrm{F}_\psi(\hat{\theta})(\hat{u}) \in [0,1]$ .Similarly $\mu_{IVF}(\hat{\theta}) \subseteq \mathfrak{A}^{IVF}$ with $\mu_{IVF}(\hat{\theta}) = \left[L_\mu(\hat{\theta}), \mathrm{U}_\mu(\hat{\theta}) \right]$ and $L_\mu(\hat{\theta}), \mathrm{U}_\mu(\hat{\theta}) \in [0,1]$.

Example 3.6.6: Considering the assumptions from Example 3.1.1, we can construct possibility interval-valued fuzzy hypersoft set of type-6 π_6 can be constructed as

$$\pi_6 = \left\{ \begin{array}{l} \left(\hat{\theta}_1, \left\{ \left\langle \frac{\hat{u}_1}{[.2,.3]}, [.21,.31] \right\rangle, \left\langle \frac{\hat{u}_2}{[.2,.4]}, [.31,.41] \right\rangle, \left\langle \frac{\hat{u}_3}{[.2,.5]}, [.41,.51] \right\rangle, \left\langle \frac{\hat{u}_4}{[.2,.6]}, [.21,.61] \right\rangle \right\} \right), \\ \left(\hat{\theta}_2, \left\{ \left\langle \frac{\hat{u}_1}{[.3,.4]}, [.22,.32] \right\rangle, \left\langle \frac{\hat{u}_2}{[.3,.5]}, [.32,.42] \right\rangle, \left\langle \frac{\hat{u}_3}{[.3,.6]}, [.42,.52] \right\rangle, \left\langle \frac{\hat{u}_4}{[.3,.7]}, [.22,.62] \right\rangle \right\} \right), \\ \left(\hat{\theta}_3, \left\{ \left\langle \frac{\hat{u}_1}{[.4,.5]}, [.23,.33] \right\rangle, \left\langle \frac{\hat{u}_2}{[.4,.6]}, [.33,.43] \right\rangle, \left\langle \frac{\hat{u}_3}{[.4,.7]}, [.43,.53] \right\rangle, \left\langle \frac{\hat{u}_4}{[.4,.8]}, [.23,.63] \right\rangle \right\} \right), \\ \left(\hat{\theta}_4, \left\{ \left\langle \frac{\hat{u}_1}{[.5,.6]}, [.24,.34] \right\rangle, \left\langle \frac{\hat{u}_2}{[.5,.7]}, [.34,.44] \right\rangle, \left\langle \frac{\hat{u}_3}{[.5,.8]}, [.44,.54] \right\rangle, \left\langle \frac{\hat{u}_4}{[.5,.9]}, [.24,.64] \right\rangle \right\} \right), \end{array} \right\}$$

4. Conclusion

The expansion of a soft set known as a hypersoft set introduces the idea of a hypersoft membership function, enabling it to handle complex and uncertain information in a more powerful and flexible way. In this chapter, several settings that are similar to fuzzy sets are considered, along with settings based on possibility degree. Numerical examples are also provided to help explain the principle behind these structures. This work can be used by researchers to comprehend and apply a range of mathematical concepts. The proposed structures can be used for developing various algebraic and topological structures.

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