**Fuzzy time and the possible impacts of it on science [11]**

$$Theory of Fuzzy Time Computation (2)$$

$$ (TC+CON(TC^{\*})ͰP\ne NP)$$

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**Abstract.** This paper is continuation of [1]. In [1], we introduce$TC^{\*}\left(Theory of fuzzy time Computation\right)$

 . Here, we prove $\left(TC+CON\left(TC^{\*}\right)ͰP\ne NP\right),$ as it was reported in [2], [3]. In [4], [5], [6] the author shows

 How fuzzy time is possible in the real Physical world.

 **Keywords.**$ $$TC^{\*},$ $scope\_{}^{\*}$, $P\ne NP,$ $P^{\*}\ne NP^{\*}$, Fuzzy time

**Introduction**

Throughout this paper, we prove$TC+CON\left(TC^{\*}\right)ͰP\ne NP.$ To do that, firstly we introduce the definition of $scope\_{}^{\*}$. This definition is based on the practical situation of computation in the real world. In the real world and real computational activities, we face finite number of efficient computable functions which work in a limited time. Inspired by this fact and considering time as a fuzzy concept, we have the definition. By employing this definition, we reach to a world of computation, in which our time is non-classical and fuzzy, so we have random generations, but the set of all computations (our computational world) is the same as we have in classical time ($TC$). The result will be $P\ne NP$ and $ P^{\*}\ne NP^{\*}.$ Throughout this article, we discuss around the impact of $TC^{\*} $on $TC$.

**Section 1** $P vs NP$**,** $ P^{\*} vs NP^{\*}$

As we say in above the central concept of the proof is$scope\_{}^{\*}$ which is inspired by the real computational activities in the real world.

$Definition $A $scope\_{}^{\*} $is a triple $\left(\{f\_{l}\}\_{l\in I},τ\_{i},[a\_{i}, b\_{i}] \right)$ in which $I$ is a finite set. $\{f\_{l}\}\_{l\in I}$ is a finite set of polynomial Computable Functions.$ τ\_{i}$ is associated fuzzy function, $[a\_{i}, b\_{i}]$ is a closed interval in real line as the domain of $τ\_{i}.$

$Definition. $Chain of $scope\_{}^{\*}$s:

For two $scope\_{}^{\*}$ $S\_{1},S\_{2}$ $S\_{1}=\left(\{f\_{l}\}\_{l\in I},τ\_{i,1},[a\_{i,1}, b\_{i,1}] \right)$is a continuation of $S\_{2}=\left(\{f\_{l}\}\_{l\in J},τ\_{i,2},[a\_{i,2}, b\_{i,2}] \right)$ if

1$.\{f\_{l}\}\_{l\in I}⊂\{f\_{l,2}\}\_{l\in J}$

2.$ b\_{i,1}=a\_{i,2}$.$ $

For two $scope\_{}^{\*}s$ $S\_{1},S\_{2}$ $S\_{1}=\left(\{f\_{l}\}\_{l\in I},τ\_{i,1},[a\_{i,1}, b\_{i,1}] \right)$is a restrict continuation of $S\_{2}=\left(\{f\_{l}\}\_{l\in J},τ\_{i,2},[a\_{i,2}, b\_{i,2}] \right)$ if

1$.\{f\_{l}\}\_{l\in I}⊊\{f\_{l}\}\_{l\in J}$

2.$ b\_{i,1}=a\_{i,2}$.$ $

$Definition.$ $S\_{1},S\_{2}…,S\_{i},…$ of $scope^{\*}$ s ($S\_{i}=\left(\{f\_{l}\}\_{l\in I\_{1,i}},τ\_{i},[a\_{i}, b\_{i}] \right)$is a chain iff for each i, $S\_{i+1}$ is continuation of $S\_{i}$ and $\bigcup\_{i=1}^{\infty }[a\_{i}, b\_{i}]=R.$

$S\_{1},S\_{2}…,S\_{i},…$ of $scope^{\*}$s is a restrict chain iff for each i, $S\_{i+1}$ is restrict continuation of $S\_{i}$, and $\bigcup\_{i=1}^{\infty }[a\_{i}, b\_{i}]=R.$

A complete restrict chain, is a restrict chain which all polynomial computable functions contribute in it.

To each $scope^{\*}$ $S\_{i}$, we associate $W\_{1,i}$ , $W\_{2,i}$,…,$ W\_{k,i}$ ,… as following:

In $scope^{\*}$ $S\_{i}$, we have interval of abstract time $[a\_{i}$,$ b\_{i}]$ ($b\_{i}=a\_{i+1}), $ and $τ\_{i}$ as fuzzy time function associated to $S\_{i}.$

$f\_{1,i}$ , $f\_{2,i}$,…,$ f\_{l\_{S\_{i}},i}$ is the list of $l\_{S\_{i}}$ “Polynomial time Computable Functions” associated to $S\_{i}$.

$Definition.$For any$ scope^{\*} S\_{i} $, in the abstract time interval $[a\_{i}$,$ b\_{i}]$ ($b\_{i}=a\_{i+1}), $ and $τ\_{i}$ as fuzzy time function associated to $S\_{i}. $At the time $b\_{i},$ we will have a set of configurations of associated Turing Machines of computing $f\_{1,i}$ , $f\_{2,i}$,…,$ f\_{l\_{S\_{i}},i} $in the interval $[a\_{i}$**,**$ b\_{i}].$Since time is considered fuzzy, this set varies by computation of the equivalent Turing machines with the same input.Conequenly, we have a set of possible sets of configurations instead of one set. Each of these sets could be considered as a set of possible worlds associated to $S\_{i}$.By above, we define $Record\left(S\_{i}\right)$ as

$$Record\left(S\_{i}\right)=\left\{W\_{1,i} , W\_{2,i},…, W\_{k,i} ,… \right\}$$

In above, $Record\left(S\_{i}\right)$ is the set of these possible worlds. If time is classical time, the cardinality of $Record\left(S\_{i}\right)$is equal to one.

The point is, at least one of these worlds is the same as when time is classical time. We rename it as $W\_{i}^{\*}$.

(It is remarkable, for $S\_{i}, S\_{j}$, if $W\_{i}^{\*}=W\_{p,i}$ and $W\_{j}^{\*}=W\_{q,j}$ , it is not essential that $p=q$).

More exactly, in any transition from a configuration $C\_{1}$ to configuration $C\_{2}$ by fuzzy time,

There is a positive probability the process of transition acts exactly like classical time case. So, in the finite set of transitions of computational activities in $S\_{i}$, there is a positive probability the whole process of computation acts as it acts in the classical time case. This provides $W\_{i}^{\*}$ as our desired element of $Record\left(S\_{i}\right),$which acts similar to the classical time case.

Now consider $\bigcup\_{i=1}^{\infty }W\_{i}^{\*}=W.$ In this world $W,$ the time is fuzzy by function $τ\_{i},$ but the functions act as classical time.

In a specific example, of a complete restrict chain (\*), let

1. $[a\_{i}$,$ b\_{i}]=[i$,$ i+1], $
2. For the polynomial time computable functions $F=\{f\_{1},f\_{2},..,f\_{n},…\},$ let the computable functions in $S\_{i}$ be the set $F\_{i}=\{f\_{1},f\_{2},..,f\_{i}\}.$

In this example we define $W\_{i}^{\*}$ as above again and consider $\bigcup\_{i=1}^{\infty }W\_{i}^{\*}=W. W$ is a world which the associated Polynomial Computable functions to it is set $F$, with non-classical Fuzzy time. The fuzziness of time, concludes the existence of random generator[1],[3]. Consequently, this world is equivalent to the classical time world with random generator. Therefore, we have $P\ne NP $ so we have $ P^{\*}\ne NP^{\*}$[1].

The first point is: All of the above discussions are true for “restrict chains” and “chains” instead of

Complete restrict chain.

The second point is about PH. Seemingly, independent of the oracle we use, the supposed random generator remains random generator. In this case, analogues to the above argument

repeat in all levels of hierarchy, Consequently, the hierarchy never collapse.$ P^{}⊊NP^{}⊊PH^{} and P^{}⊊NP^{}⊊PSPACE^{}$ $(P^{\*}⊊NP^{\*}⊊PH^{\*} and P^{\*}⊊NP^{\*}⊊PSPACE^{\*})$.

So,$PH^{}⊊PSPACE^{}$$(probably a parallel proof shows, PH^{\*}⊊PSPACE^{\*}, should be checked $

$more carefully)$.

$Remark.$In the above conclusion, some are theorems in $TC$ but we need $CON( TC^{\*})$ and existence

of a model for $TC^{\*}.$ It is noticeable that, our language is not first order. More exactly, we have

1. $TC + CON\left( TC^{\*}\right)ͰP\ne NP,P^{}⊊NP^{}⊊PH^{} ⊊PSPACE^{}$

The second type of conclusions, needs $ TC^{\*}$ as premises too,

 2.$ TC + CON\left( TC^{\*}\right)+ TC^{\*}$ $Ͱ P^{\*}\ne NP^{\*}, P^{\*}⊊NP^{\*}⊊PH^{\*}⊊PSPACE^{\*}$

In above, by $CON\left(T\right)$ we mean theory $T$ is consistent and has a model.

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