Proposed Hypothesis on replacing Non-Deterministic Approach to Abstraction due to the exhibition of faulty speculations

Shreya Indukuri[1], Anil Kumar Reddy Konda[2], Mellacheruvu Janakirama Sharma[3]

Student, Department of Computer Science, India.

[1]*indukurishreya@gmail.com* , [2]*anil76201reddy@gmail.com* , [3]*mjanakiram@gmail.com*

Abstract—**Non-Determinism is the word that is used to refer to an event or a series of the same that is said to be unpredictable but is assumed to be belonging to a domain of possibilities. From the inception, non-deterministic approaches have played a huge role in statistics, machine design, the definition of Random, and a few other domains to mention. Non-Deterministic processes are defined as the paths that lead to no fixed state but a set of possible states instead. One of the crucial reasons would be delving into the human understanding of processes and the ability to justify happenings around. A behavior that has accumulated throughout the evolution of mankind is to explain boundaries based on what is being perceived. The argument of Human Understanding of processes around can be of huge prominence as they play a vital role in explaining and demystifying a lot of misconceptions. One such aspect that is a resultant of this phenomenon would be a nondeterministic approach. The key focus of this paper will be on emphasizing how humans are limited to perceiving reality, how several misconceptions have accumulated around misstated definitions by the virtue of the same, have a closer look at Randomness, a sheer epitome of the same, and also propose a few potential applications that are affected by the hitherto stated problem.**

Index Terms—**Random, Pseudo-Random, Deterministic, Non-Deterministic, Computation, Abstraction, Probability**

I. INTRODUCTION

IN THE ideology of imagination, and information passing system is a folk of glimpse which influences the human consciousness, this apt perception together designs a computation leading to the approach of the computational theory of mind. The theory of computation is a field of study that focuses on how methodically problems can be determined with the stimulation of algorithms. This field is extensively subdivided into three considerable concepts, automata theory and formal languages, computational complexity theory, and theory of computability. One of the certain classes of automata theory includes algorithms practicing Deterministic and Non-Deterministic ways of approach. The term Determinism signifies the dearth of a free desire where it contradicts the concept of randomness and assures an accurate calculation towards any happening. Practically, every event with a provided pattern operates in such a manner that every current state is entirely dependent on its preceding states. If something is deterministic, you have all of the data necessary to predict (determine) the outcome with 100% certainty.[1] The procedure involved in calculating the result from all the data feasible is simply referred to as a deterministic process. In other words, if we can predict with 100% certainty where a y-value is going to be based only on our x-

value, then that's a deterministic relationship.[1] The concept of Non-Determinism has been defined to intervene when there is no possibility of a theoretical path of predisposing the structure's accurate performance. This behavior might sometimes be certain as well as uncertain depending upon unpredictable situations which might be the complexity, visibility, dependability, or many more. According to conventional theory, a Non-Deterministic approach is a structure that outcomes distinct results or behaviors on each run. A nondeterministic algorithm represents a single path stemming into many paths, some of which may arrive at the same output and some of which may arrive at unique outputs.[2] There might not be any assurance of a guaranteed solution for every possible path, but there will be a true solution for any one of the possible paths. However, on closer observation, it occurs with obvious implications that every happening has a well-defined and quantifiable process running in the back-end. Usually, the non-deterministic approach is applied when we are in search of an approximate result, as the accurate result will only be produced via the Deterministic Approach which costs much higher than the Non-Deterministic approach. Through this paper, the authors intend to modulate the perception of conventional Non Deterministic theory where it has been stated that for an event/series of events, the system exhibits unpredictable varied outcomes. On the contradictory, the key focus of this thesis would be to initiate a thought process in a particular direction by conveying that there seldom exists a non-deterministic process as such. The conventional theory has resulted in faulty consequences for many of the day to day applications.

II. RELATED WORK

A. Scope of Argument

It might be argued that the definition of non-determinism that is currently established leaves no scope for a loop-hole and is ideal. But the following considerations are to be made prior. Non Deterministic processes are said to lead to a set of possible outcomes rather than a single outcome itself, as the path of flow of the process might not be determined with ease. Be that as it may, it also follows that with a critical understanding of a happening and a technologically advanced computational means, there exists seldom an outcome that remains to be unexplained. This includes events that fall into the bucket which preponderances of all communities

have been considering to be uncertain for now. Also, the role played by non-deterministic processes in day to day scenarios cannot be looked down upon. With such an opinion, one definition that could safely replace the conventional existing definition and still fit in every application is of abstraction. Abstraction is the property by which an entity fails to interact/know about another entity. Although how abstraction is achieved can be vague and context centred, it can be validly stated that the usage of non-determinism finds productivity due to abstraction of the involved processes. Unpredictability or Uncertainty is to be approached as ambiguities that arise due to abstract level processes that are too complex to be processed and calculated that they end up being ignored. This shouldn't interfere with the fact that a happening can still be predicted or explained with a proper trace back of available data.

B. Randomness and it's Prominence

The word Random is used to describe the insignificance of an event/entity. For an event/an entity to be labeled as random, it requires that there be an absolute lack of relevance and predictability. Randomness finds a lot of prominence in the domain of statistics and Machine Learning. Randomness is used as a tool to help to learn algorithms to be more robust and ultimately result in better predictions and more accurate models [3]. There can be varied sources for randomness under machine learning i.e., in Data, Evaluation, Sampling, and Algorithms. Having a deeper look, a random data sample from the collection can be considered to evaluate the model, we use randomness for proper evaluation and fitting of the proper validation as the outcome, it helps the algorithms to avoid the risk of overfitting the tiny training set and standardize the extensive problem. Within a software, a random number generator is operated to generate random numbers.

It's a simple math function that generates a sequence of numbers that are random enough for most applications.[4] This math function is deterministic. If it uses the same starting point called a seed number, it will give the same sequence of random numbers[4]. The best use is to get reproducible results by fixing the random number generator's seed before each model we construct. It's better to make a good practice to include a default section of every attempt, where we must try to give the exact sequence of random numbers to every individual algorithm trying to compare and analyze using certain techniques.

C. Randomness and Non-Determinism

It would then follow that Randomness and Non-Determinism go hand in hand. A justification that is believed to be appropriate in this context says that the outcomes of a non-deterministic approach can be considered to be random. Let us consider for instance that there is a nondeterministic finite automaton that can reach 2 states Qa and Qb when confronted with an input symbol x. Now, in the case of x being given as an input to this non-deterministic system, it would be unpredictable to conclude on the state that this au-

tomaton will settle for (it could be either of Qa and Qb). On a much-detailed observation, it would appear obvious that either of the states occurring with equal probability implies that the actual state of settlement is of insignificance and is completely deprived of a pattern. Due to this reason, the states are said to be random.

D. Everything that is wrong with the above approach

Random vs Pseudo-Random is a debate that is commonly prevalent among computer scientists, mathematicians, and statisticians. This debate is a result of an inconsistent explanation of the aspect of randomness and is bolstered with algorithms prescribed for randomness (an algorithm is a well-defined process). The above-described perception and explanation might appear to one as firmly justifiable and valid until the below aspects are taken into consideration.

1) The Concept of Non-Determinism

An inferable statement from the above explanation has to deal with the extent of the unpredictability of the outcome. Even Though the fundamental definition of non-determinism is about the unpredictability of outcomes, a detailed contemplation about the same would suggest that no occurrence can be unexplained. Having said that, many events are too complicated and costly to be reasoned that they are just labelled as irrational and random. But with rapid advancements in technology and zeal to explore reality a little further, more and more events are being explained and predictable than ever before.

During a simple event of tossing a coin, the prediction of the outcome of the event becomes so complicated and error-prone that the outcome is considered uncertain. However, be assured that this event is in no way unpredictable and can be strictly explained through rotational dynamics making it highly predictable. The ignorance that mankind has imposed on the predictability of such events is a sheer case of an anomaly with a human process which is omnipresent when the value of gravity is taken to be 10m/s2 instead of 9.8m/s2 to consider 0.333333333 as 1/3. Such ignorance led to inconsistent explanations as stated herein.

2) Relevance with probability

Processes that are considered to be non-deterministic as per the conventional definition are omnipresent when there comes a need to bring in equal probabilities and uncertainties. Since the outcomes of non-deterministic occurring are unpredictable, it would follow that Random values generated as a result of a nondeterministic occurring are bound to concord with probabilistic estimates. Hence such events are used in contexts that require equal probabilistic occurrences. When two teams are under conflict to decide on the winning team, a coin is tossed (as the outcome of the coin is too complicated to predict, it is considered random making the probability of outcome fairly equal) giving both the parties an equal opportunity to win. On the contrary, as per the conventional definition of random, a random outcome should have no relevance meaning an outcome of a strictly biased

event could still be considered random as long as the outcome has no relevance. If one is asked to generate a random number in the interval of (1,3) (excluding both the boundaries) then the outcome would always be a 2 which can still be random but not so unpredictable.

3) The question of irrelevance

As per the traditional definition of randomness, it would follow that a random entity is bound to be irrelevant to the context and completely independent of the context of the application. However, in this scenario, it becomes obvious that there is a huge prominence for the values that are said to be random. Once these random values are mapped to real-time events, they inherit some significance by the virtue of their value making them no more random.

E. Case Study

1) Schrodinger's Cat Experiment

Schrodinger's cat experiment is a classical experiment in the history of quantum physics that is believed to be a demonstration of randomness. In this experiment, a cat was placed into a box containing radioactive substances. As time progresses, there occurs a decay in the radioactive substance triggering a Geiger counter which results in a toxic explosion that might or might not kill the cat. Once this experiment is carried forward, until the box is opened up, one cannot be assured of the outcome of the experiment i.e. whether the cat is alive or dead and hence, the outcome is said to be random.

This justification of the experiment is flawed based on what was just stated above. The outcome of the experiment contradictory to the popular belief is much predictable and traceable based on scientific calculations. Presently, the rot of the radioactive substance is administered near the laws of quantum mechanics. This implies the particle begins into a consolidated preparation of "going just before rot" afterward "not going away near rot". If we apply the spectator driven plan to this case, so the entire framework remains as a blend of the two prospects. The cat finally ends up each useless and alive at the same time. Because the life of a cat that is each useless and alive at the same time is absurd and does not take

place in the actual global, this thought test suggests that wave function collapses aren't just pushed by conscious observers. The outcome of the experiment has more to do with quantum physics and nuclear physics which would bring in complex calculations making it very much strenuous job to predict given the high chances of error and high precision computations that prevail. Be that as it may, human incapability to predict a few happenings shouldn't imply an unpredictability of an event itself as such. Happenings however complicated and uncertain they may appear, are still predictable or in the alternate direction traceable for their current state and there is nothing unpredictable as such.

In summary, quantum state collapse isn't driven simply by aware observers, and "Schrodinger's Cat" was simply a teaching tool fabricated to undertake to form this truth addi-
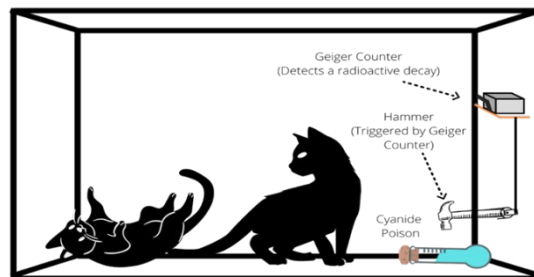
Fig 1. Schrodinger's Cat Experiment

tional obvious by reducing the observer-driven notion to absurdity. Sadly, several standard science writers in our day still propagate the misperception that a quantum state (and thus reality itself) is set by aware observers. They use this inaccurate claim as a springboard into aery and non-scientific discussions regarding the character of reality, consciousness, and even jump mysticism. To them, "Schrodinger's Cat" isn't an associate degree embarrassing indication that their claims square measure wrong, however proof that the globe is as absurd as they claim. Such authors either see Schrodinger's Cat or deliberately twist it to sell books.

III. PROPOSED THEORY

A. Abstraction in and as Non-Determinism

In the face of conflict as such, one would want to have an alternate approach to non-determinism and randomness that would be a proper substitute to the conventional definition being followed. It can then be safely inferred that based on all the anomalies and contradictions herein, abstraction as a mechanism would properly suffice and substitute for all the ideologies and applications of non-determinism and randomness.

Abstraction is the mechanism that ensures no complete knowledge about one end of a phenomenon reaches the other end. The role played by abstraction is very critical in the discussion of randomness and non-determinism as follows.

B. Justifying Unpredictability

The assumed unpredictability of non-determinism is properly established with the help of abstraction. A process running at an abstract level does not reveal complete details about itself and hence the outcome becomes unpredictable. It may then be argued that the process continues to be definite and predictions can be made out of insights or statistical inferences. But it is to be noted with caution that by drawing insights or statistical inferences about a process, one is exploiting its abstraction hereby making it no more uncertain. In the case of Schrodinger's cat experiment, the outcome of the experiment is put at an abstraction until the box is opened and hence the uncertainty that follows explains everything.
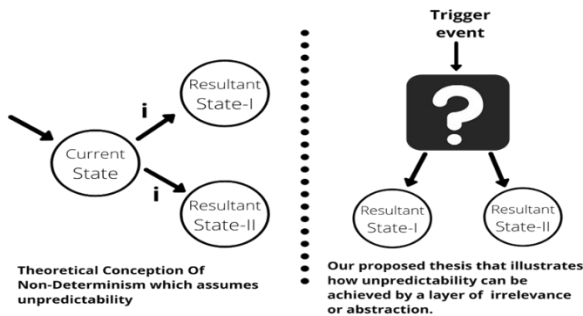
Fig 2: A figure representing how the abstract concept of non-determinism can be implemented using abstraction/irrelevance

Fig 3: Figure distinguishing how probability and statistics differ as per predictabilty
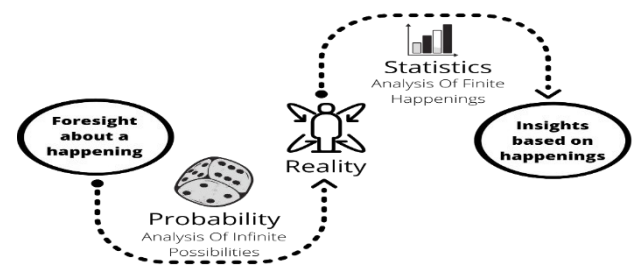
C. *Abstraction of Relevance*

It would follow that the ideal definition of random defines irrelevant entities/values in a scenario. This can also be satisfied by putting the context of usage at an abstraction to the algorithm of production. With events occurring at an abstract level, the relevance of the outcome would be undefined as such and hence abstraction can ensure irrelevance. One counter-argument that can be made at this point of the discussion revolves around the fact that mathematical and statistical means can be used to explain the nuances of events and their outcomes even if put at an abstract level. However, by doing so, one is again disturbing the layer of abstraction and bringing in relevant insights about the happening here by breaking the conditions needed for nondeterminism.

In the case of tossing a coin or rolling a dice, abstraction usually prevails as users are seldom aware of the metrics and their values needed to reach a prediction with certainty. However, it is to be noted that this abstraction can be broken making the event predictable and biased.

In the case of the Schrodinger cat experiment, the outcome of the experiment i.e. the cat being alive or dead is put at an abstraction to the experimental setup. Also, the outcome is irrelevant as the context of usage is undefined and independent of the underlying process. Simply put, the cat is alive or dead has no relevance to external surroundings and hence the outcome is considered insignificant.

D. *Around Probability*

From the previously stated, it is clear that a context of usage, relevance, and a disruption of the envelope of abstraction surrounding a process would make it no more uncertain and hence cannot be considered non-deterministic. It would bring in obvious implications as the probability is applicable for events with quantifiable and ideally equally likely outcomes. But to prove or disprove or even learn the probabilistic progress of an event is to determine the frequency of outcomes corresponding to an event which again tampers with the abstraction layer of the experiment. Simply put, even if one were to generate the same number/entity for an indefinite amount of time, it is to be accepted as random given the context of usage is an abstraction to the method of generation. The moment this algorithm of generation is challenged and put to test is the moment that the algorithm loses its property of randomness.

IV. CONCLUSION AND FUTURE SCOPE

The traditional definition of non-determinism as illustrated in this paper is tainted and has not covered all the possibilities of uncertainty, therefore it can be proved that the traditional definition leads to a false conclusion for non-determinism. Be that as it may, it can also be observed that despite an unsound definition, the processes or events that are in play to bring about nondeterminism well did the job. However, it is of utmost prominence to alter an incorrect way of perception so as to rectify a direction of research that can follow as a result of this incorrect perception. In this paper, the authors have proposed a modified version of the traditional definition and this shift in perception has been a safe one i.e. the proposed definition majorly changes the ideology or explanation of certain events yet happens to satisfy all the previously existing applications without any actual need to change. The replacement of unpredictability of nondeterminism with the abstraction process of non-determinism or even realizing that the latter results into the former for that matter would trigger a sequence of thoughts and hence result in much more convenient and justifiable implementations of random and non-deterministic processes. This does not result in any change of the system but the definition itself is redefined from the traditional definition. All the change that is needed is in the way of perception.

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