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Providing Insights into the Importance of Deep Learning for Dream Interpretation

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Abstract
The importance of deep learning has been emphasized for dream interpretation. A framework based on deep learning is provided which can be utilized by dream analysts for interpretation of dreams in consultation with the dreamer. The novelty and utility of this framework is also proved by providing supporting facts. The framework is limited by its capability to provide the details of the events of dream that have not occurred. Also the concerns related to the usage of computational model for implementation of framework have been highlighted.

1. Introduction

Human brain is considered to be the most powerful and it has got an amazing capacity to process information based on the stimuli received through one or the other sensory organs. Number of researchers has given different frameworks to mimic the way the information is processed by human brain [1-3]. As far as human brain is concerned, it is all about the connectivity of neurons, in fact there is the synaptic cleft which receives information from one neuron and passes to the other neuron to finally generate some significant outcome. This significant outcome can be motion of the some part of the body in response to the input [4-5], it can be an answer by a student to the question asked by a teacher in a classroom or response in some other form with respect to the input/stimuli. For example, while writing this paper, number of ideas came to the mind, these were then processed through the interconnection of different neurons and the final outcome is the rearrangement of all the ideas in a meaningful and informative manner. Hence the three important factors involved are: Input/stimuli (received through different sensory organs), Processing of Input (interconnection of neurons) and finally, the output in the form of response (meaningful information conveyed). These are the three key concerns around which the term Artificial Intelligence (AI) has been coined and flourished.

The existence of the term AI in the current scenario is supported by deep learning, which has provided computational methods in a better manner for image/text, audio/video recognition and genes mapping. The heart of computational methods in all the domains is multilayer perceptron which provides abstraction of data at every layer as compared to the previous layer [6]. Abstraction is achieved through network training by huge processing of data at different layers.

It can be visualized that deep learning has found its application in almost every area, but missed to provide the methods for information processing that takes place during the subconscious state of mind which takes the flashes of events as inputs that happened during the conscious state of mind (i.e in waking life) and final response is given as a story comprising of all the events in some or the other ordered manner. This final response as a story in the subconscious state of brain is termed as dream. Dreams take the person to entirely different zone of experiences. But it is not yet completely understood how to analyze/interpret those experiences. Hence the objective of this paper to highlight the importance of deep learning for interpretation of subconscious state of human brain, that is dream analysis. In this paper, a framework is proposed based on deep learning that can be utilized for dream analysis.

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2. Frameowork For Dream Interpretation Using Deep Learning

Dreams allow a person to release his/her hidden emotions/feeling during subconscious state of mind. This is done by recording the person's conscious state of mind and later on replaying the same during the dreams. Hence dreams facilitate a person to execute the actions which they are not able to perform in conscious state of mind. It seems as if the complete brain activity is being controlled by some mystic power in subconscious state and this mystic power is trying to fulfill the wishes of dreamer in subconscious state.

Since execution of actions in subconscious state of mind is specific to person, interpretation of these actions is also dreamer specific. No generalized statements can be framed for a particular dream for different persons. This necessitates the framework development for dream interpretation where the dreamer himself/herself plays an important role for dream interpretation.

This framework utilizes the concept of deep learning for dream interpretation in which the brain processes the events from waking life by assigning the different weights and processes it to output a story composed of the events in the form of a dream. More the weight assigned to a feature, more prominent the component would make the part of a dream.

As can be seen from the diagrammatic representation of the framework shown in Figure 1, "N" Events from the waking life form the input to the deep learning network and these "N" Events are processed through "M" Hidden Layers in the deep learning network. These "N" Events from the waking life are processed to provide the output in the form of a story during sleep and is termed as dream.

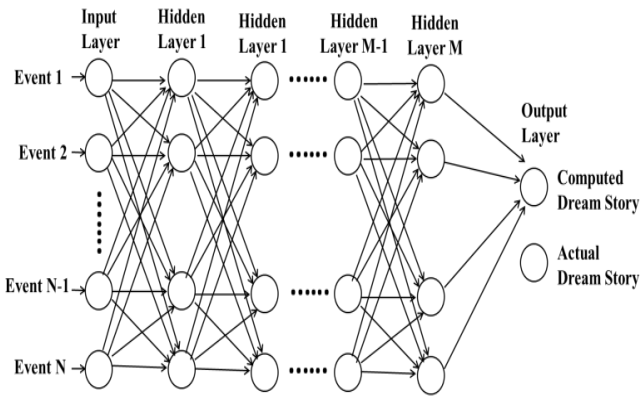

Fig. 1 Framework for Dream Interpretation based on deep learning

The utility of the proposed framework is suggested in the following two ways:

1. Components of the dreams as input (Events from waking life held in past) and the dream itself as output.

2. The dream itself as input and components of the dream (Future Events) are to be obtained as output.

2.1. Components of the dreams as input and the dream itself as output

This view of the framework represents the capacity of brain that actually uses the concept of deep learning. In this case, the brain itself has processed the different events from the waking life to output a story in the form of dream. In this case, it is not known that how many processing layers of perceptron has been utilized by the brain to process the input components into dream.

In this scenario, the person himself/herself can analyze the dream because he/she is very well aware of the input events from the waking life that had already happened in the nearby or immediate past.

The weights assigned to the different input components is totally dependent on the person because it's only the person whose subconscious state knows that how much importance the person has given to a particular input component in his/her conscious state. Accordingly the dream is defined in the subconscious state as a bad/sad story totally dependent on the person involved.

2.2. The dream itself as an input and components of the dream are to be obtained as output

This is the scenario, where the dream interpretation actually comes into the picture. Here the person only has a dream, but not able to relate the components of the dream from the events in nearby past. This is important for the persons, who are able to see the upcoming events well in advance in the form of dream. But, only the person himself/herself can conclude later on, how the dream in past was actually related to what is happening in the present (i.e. after the dream was over). Hence this framework can definitely help such persons to answer a number of questions like: How the dream is going to become a reality? In how much time the dream will convert into reality? Which perspectives of life are going to be affected in near future based on the current dream?

This framework will definitely influence the dream analysers to help the persons analysing their dreams and also help them in analysing which perspectives of life are overwhelmed and are over controlling the brain of the person concerned. With the help of this framework, the concerned persons will also be able to prioritize the real life activities that will help them organize the life in a better way.

3. Novelty of the Proposed Framework

Many diverse studies have been proposed in direction of dream analysis and dream interpretation. Scientists have worked in direction to integrate the psychological and neurobiological perspective for dream interpretation. This research area is yet to be explored further to incorporate number of divergent but related concepts. A concept has been provided in the form of computational framework in direction of dream interpretation and its novelty is supported by the following facts:

1. Cartwright [7] has elaborated on an importance of REM sleep in learning and refreshing memory. This is done by re-establishing connection, allocation of new information to the brain and hence actively representing the brain.
   This is again self-organization of the brain during REM sleep. Technically, allocation of new information to the brain during dreams means increasing the associated weights of different neurons resulting in the reestablishment of connections. Our proposed framework for dream interpretation based on deep learning is the outcome of representation of the above stated concept which has not been earlier thought of.
2. Shields [8] in his paper has highlighted the importance of correlation between neuronal biological aspects and psychoanalysis. The proposed framework is an initiative providing the platform where the interplay between neurobiological aspects and psychology has been demonstrated for dream interpretation.
3. Kriegeskorte et al., [9] in their work have defined the unified neuroscience system encompassing the measurements of brain and behavioral activity along with the computational models. The unified system ensures to have integrated interpretation of data from the psychological and neuroscience perspective. But till date no exclusive computation framework has been provided for dream interpretation that can detail out the description from psychological and neuronal perspective.
4. Starzyk and Prasadin [10] have worked towards inculcating consciousness into machine and hence making the machines intelligent. In order to attain this objective, they have proposed a computational model driven by mental saccades. Contrary to this computational model, our proposed conceptual framework utilizes artificial intelligence for explaining the mental states during dreams, hence acting a platform for dream interpretation.
5. Dream scenes happening mainly in REM sleep are interrupted mainly due to self-organization of brain. Also Bob and Louchakova [11] have emphasized on the limitation of correlation between dreams and dis continuous states of minds which can be further explained using self-organizing theory of dreams and discontinuous states arising due to numerous transitions of neural firing patterns. But no framework has been suggested by authors through which self-organizing theory of dream can be explained.
6. Shaw [12] in his review paper has highlighted the contribution of neuroscience in understanding the work done by Freud towards dream interpretation and also defining the term consciousness from neurobiological perspective. But still are missing directions that are yet to be identified in direction of neuroscience for dream interpretation.
7. Kriegeskorte and Diedrichsen [13] have also proposed deep neural network as a brain computation model for simulating brain activities. On the similar lines, the proposed framework comprising of deep neural network can be utilized for dream interpretation and results can be later on validated by performing brain activity measurements based on neuronal activity recording.
8. Recently Gott et al., [14] have given functional interpretation of Ponto-Geniculo-Occipital (PGO) waves. Along with this, they have also highlighted the requirement of development of theoretical model for further psychopathological research. From the literature, it is obvious that till date no framework has been proposed through which the integration of brain neuronal activity and the computational framework can be demonstrated for dream interpretation.

4. Discussion For The Justification Of Proposed Framework For Dream Interpretation

Deep learning based framework for dream interpretation is strongly supported by following facts:

1. Theory of self-organization [15] couldn't explain which events/memories from past will be activated during the dream, but with the proposed framework can easily tell that events assigned more weights using the deep learning computational methods will definitely be incorporated in the dream.
2. It has been pointed out by many researchers that events in conscious state are reflected in dream, but Continuity Hypothesis is not explained [16-22]. The proposed framework based on deep learning explains the Continuity Hypothesis by training the network to assign the weights to the different events from dreamer's perspective.
3. This framework is also consistent with the latest two phase memory model given by Zhang wherein the important aspects of walking life of the dreamer are reflected in immediate dream and less important aspects stored as temporary memory in hippocampus will be assigned new weights a few days later in neorcortex, hence resulting in a new description [22].
4. This framework is closely related to the dream interpretation of

NREM sleep [23-25] as dreams in NREM sleep are more related to the dreamer's conscious state experience.

5. Lucid dreaming as a metacognitive activity explained Filevich, Dresler, Brick and Kühn [26] is also based on the deep learning network naturally followed by the brain to process information.

5. Conclusions

With the proposed framework based on deep learning for dream interpretation, it is possible to relate the dream to the immediate past events by assigning the weights to different events as per dreamer's perspective. This weight assignment is totally based on the relative importance of events that occurred in immediate past of the dreamer. This interpretation is all about relating the dream to the events in immediate past. But this framework is a subject to number of investigations where events are to be extracted from the dream from the dreamer's perspective, because the story presented in the dream is new and the dreamer is not able to relate the same with the immediate or nearby past events. This scenario reflects the investigation of most likely events that will take place in immediate future. Hence to convert the framework into actual computational model, following aspects are still questionable:

1. How many hidden layers should be there in the back propagation network so that proper weights are assigned to the different events as per dreamer's perspective?
2. Since dream interpretation will be specific to dreamer, can the same number of hidden layers be utilized for dream analysis of different persons?
3. Whether the same number of hidden layers would suffice for investigation of future events from the dream?
4. Also how will the deep learning network be trained to assign the different weights in each/every hidden layer based on the comparison between actual dream and computed dream to analyze the dream for retrieving the upcoming events?
5. Whether with the proposed framework, is it possible to generate more specific information at the current layer as compared to the information retrieved at the previous layer [27]?
6. To what extent, the dreamer will be able to control the inter-connectivity of neurons resulting in a specific dream as per his/her choice during lucid dreaming?
7. Can reinforcement learning be incorporated in the in framework and will the proposed network based on reinforcement learning be able to produce the expected results specific to different dreamers [28]?
8. Can this framework be utilized for dream interpretation of persons subjected to anaesthesia induced during surgery and analysing which portions of the brain were highly active?
9. Most importantly, whether the proposed framework can be standardized for different patients with induced anesthesia to identify the active brain regions?

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