**Title:**

Deep Learning in Genomics

**Proposal:**

Deep Learning is a subcategory of Artificial Intelligence that enables learning and analyses through unlabeled data using unsupervised learning. It is also referred to as the deep neural network or deep neural learning. Genomics, on the other hand, is the study of the genome, the complex structures of DNA. Deep learning is used in several genomics applications including multi-sequence alignment in which the DNAs or amino acids are aligned to analyze the similarities and study about the common behavioral traits and hence get an understanding of evolution.

**Synthesis Matrix:**

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| --- | --- | --- | --- | --- | --- | --- |
|  | **Deep Learning for Genomics** | **Deep Learning models in genomics; Are we there yet?** | **Deep learning for plant genomics and crop improvement** | **Artificial Intelligence in genomics** | **Artificial Intelligence and Machine learning in genomics: Applications and Predictions** | **Can deep learning improve genomic prediction of complex human traits?** |
| **Main Idea A** | The human genome has 3 billion + base pairs and DNA strands have connections from genotype to the phenotype that exhibits regulatory functions. | Biotechnology and bioinformatics use convolutional neural networks (CNN) of deep learning. | Deep learning in plant genomic starts with DNA sequences and continues until observation of phenotypes. | The genomics market is flourishing and startups using deep learning and NLP in genomics are thriving too. | Deep learning has applications in all regulatory, functional, and structural genomics. | Deep learning’s CNN and Multilayer Perceptrons are used in complex traits analysis in genetics. |
| **Main Idea B** | Deep learning in genomics has higher potentials in the diagnosis and treatments of complex diseases and disorders. | There are several fusions in DL and ML for enhanced learning and outcomes such as the multi-model fusion for meta-analysis. | DL uses the technological advancements to identify and prioritize the possible functional variants and thus helps in crop improvement. | Deep neural networks help with relation identifications, entity recognition, and retrieving information in genomics. | Deep learning in genomics helps to analyze imagery data and blended with computer vision, it can solve several issues. | From the molecular information’s access, it is tricky to check the phenotype of an individual using deep learning. |
| **Main Idea C** | Several authors are working on deep learning and how the convolutional neural network discovers the DNA-binding motif. | DeepTarget and deepMirGene use RNN and LSTM, the two types of DL’s neural networks for predictions in genomics. | Deep learning uses an unsupervised learning approach for data analyses of plants and crop genomics. | Deep learning can be helped in predicting DNA methylation, crop breeding, and improved productions, and achieving customized profiles in genomics for people. | Deep learning can also provide analysis of genomics texts that are used in several pieces of research. | CNN exploits the correlation between the nearly similar traits by using putative connectivity patterns between them. |
| **Main Idea D** | Deep learning has made most of the success in functional genomic analyses and RNA identifications and other regulations of the genome. | Deep learning ensures accuracy in regression while inferring the data during human gene studies. | Deep learning has applications in large scale analyses of data to resolve several genomics issues. | Deep learning can understand metabolic modeling and provide novel genotypes for coping with challenging environmental changes. | Deep learning has many genomics applications like gene editing, clinical workflows, genome sequencing, and consumer genomics products. | The accuracy in prediction through the Bayesian Linear method approach in deep learning depends on heritability. |
| **Main Idea E** | Datasets for deep learning in genomics must be handled with care as even the slight variations might lead to several giant effects on the outcomes and hence the study. | DL is also used to predict the responses of several treatments including the advanced ones to be involved for cancer treatment. | Deep learning’s variant in genome-wise identification can help with future improvements in crops. | Deep learning combined with genomics has several types of research and is crucial for proper human survival and eradicating issues including poverty and hunger. | There are future applications of deep learning and ML in genomics like pharmacy genomics, newborns’ genetic screening, and agriculture. | CNN has several applications on human genomics predictions and data analyses, but there are several advancements still to be made in the field. |
| **Main Idea F** | Deep learning might make success in several other aspects of genomics like gene regulations and mutation effects. | In genomics, with DL, several new pieces of research are going on in heterogeneous data integration. |  | Deep learning can be used for predicting gene relations too and genetic functions and interactions. | Deep learning combined with genomics is cost-effective and eradicates several issues to ensure better lives. |  |

**References:**

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