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Application of Artificial Intelligence in Developing a Brain to Text System to Help the Disabled

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Abstract: it has long been speculated whether communication between humans and machines based on natural speech related cortical activity is possible. Over the past decade, studies have suggested that it is feasible to recognize isolated aspects of speech from neural signals, such as auditory features, phones or one of a few isolated words. Continuous spoken speech can be decoded into the expressed words from intracranial electrocorticographic (ecog) recordings. Techniques from automatic speech recognition (asr), thereby transforms brain activity while speaking into the corresponding textual or digital representation. Speech is produced in the human cerebral cortex. Brain waves associated with speech processes can be directly recorded with electrodes located on the surface of the cortex. Currently the system decodes the continuously spoken speech and transforms it into a textual/digital representation. Here the cortical information is combined with linguistic knowledge and machine learning algorithms to extract the most likely word sequences. The data that is extracted is currently based on audible speech processing. However, the results are an important first step for recognizing speech from thought alone. Thus, our paper mainly focuses on the primary steps as to how we could achieve this.
Keywords: Artificial intelligence, intracranial electrographic (ecog) recordings, machine learning

I. INTRODUCTION

Much of our knowledge about neural computation in humans has been informed by data collected through carefully controlled experiments in laboratory conditions. It is known that neuronal responses may differ between experimental and freely behaving natural conditions. Therefore, developing robust decoding algorithms that can cope with the challenges of naturalistic behavior is critical to deploying BCIs in real-life applications. One strategy for decoding naturalistic brain data is to leverage external monitoring of behavior and the environment for interpreting neural activity. We use computer vision, speech processing, and machine learning techniques to automatically determine the ground truth labels for the subject (Users) activities. These labels are used to annotate patterns of neural activity that is hence discovered. There is test case described as, manual intervention to validate the interpretation of data and the other being the system which automatically validated the interpretation that has been made as per the data. These results would suggest that our unsupervised (Automated) approach may offer a reliable and scalable way to map functional brain areas in natural settings and enable the deployment of ECoG BCI in real-life applications.

Intracranial electrocorticography (ECoG) as a technique for observing human neural activity is particularly attractive. Its spatial and temporal resolution offers measurements of temporal dynamics inaccessible by functional magnetic resonance imaging (fMRI) and spatial resolution unavailable to extracranial electroencephalography (EEG). Efforts to decode neural activity are typically accomplished by training algorithms on tightly controlled experimental data with repeated trials. The lack of ground-truth data makes decoding naturalistic neural recordings difficult. Supplementing neural recordings with additional modes of observation, such as video and audio, can make the decoding more feasible.

II. METHODOLOGY INVOLVED

This section focuses on the application point of view using A.I. and ECog device to recognise patterns and infer details. Speech is produced in the human cerebral cortex. Brain waves associated with speech processes can be directly recorded with electrodes located on the surface of the cortex. It is possible to reconstruct basic units, words, and complete sentences of continuous speech from these brain waves and to generate the corresponding text. Recording and deciphering those signals and reproducing the outcome through automation is the objective of this system.

There are mainly 4 techniques used:

A. Single-channel EEG
B. Functional MRI
C. Near infrared imaging

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D. Artificial Neural Networks

E. Machine learning techniques

F. The following are the Interpolation of the Techniques Mentioned As Above.

1) Single channel signal can provide high accuracy of differentiation depression EEG.

2) Artificial neural networks operate on biological institutes and perform biological evaluation of real world problems. Neural networks can result in more success in pattern recognition and classification compared to purely conventional techniques. To become more widespread, development of new models is required that. These techniques would be able to manage complicated and complex real-world problems.

3) When neurons in the brain interact via chemical reactions, measurable currents called brain waves are created The data is interpreted as follows:

4) Using EEG Technique, the brainwave data is fed into the system, which searches for links between individual sounds and distinct patterns of electrical activity. Thus, being able to translate certain patterns of brain activity into words

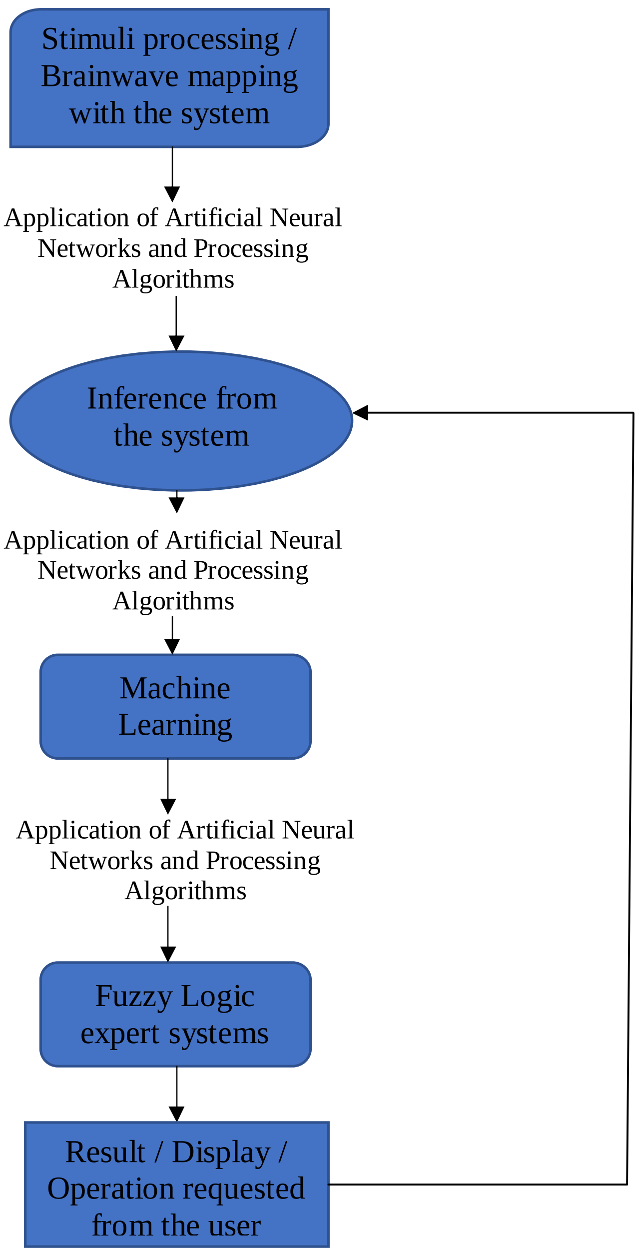

Figure 1. Process structure of how the data interpretation with take place

III. RESULT

Replacing human intervention for highly specialized operations
Can be easily documented.
Results can be easily transferred and reproduced.
The understanding of the working of neurons and the pattern of their interconnection can be used to construct computers for solving real world problems.
Fuzzification provides superior expressive power, higher generality and an improved capability to model complex problems at low or moderate solution cost.
Industrial Automation and Applications

A. Advantages

1) Prosthetic control
2) Manipulation of electronics using thoughts
3) Improve attention spans
4) To detect diseases

B. Challenges

1) The skull blocks a lot of the electrical signal, and distorts the signals that get through
2) Invasive surgery
3) Formation of scar tissue

C. Artificial Intelligence

The application of Artificial Intelligence in this scenario evolves around three stages: data collection, data analysis and forecasting. The pre-assessed data from the brain mapping device would be the foundation for AI machine learning and forecasting capability. The system uses neural algorithms and machine learning for network self-management minimizing human involvement and optimizing a dozen of network parameters automatically.
The components involved are as follows:

1) Intelligent Routing
2) Scope for natural language processing (NLP)
3) Text-to-Speech and vice versa

D. Extensible Application Interfaces for the inferred data (APIs)

The data flow may be easily integrated with the clients existing ERP / IT system or frontend through HTTP-Get/Post /APIs. Our A.I. which helps in data interpretation would be hosted on the central node which receives the data and establishes an offline (Without cellular network) intelligent intracity network where we could process and mine the fragments of data which might be needed for further research.

E. Deep Neural Network

Deep Learning has been very famous of late and a lot of research is going on over it. The reason to implement this is because of its capability for the neural network model to increase the performance and response time of the system. Selection of relevant parameters among the data is done to find the dependency among the variables. It can reduce the complexity of the problem to a large extent. Neural networks hence serve a huge purpose in machine learning. Deep learning methods are part of distributed representation learning algorithms that try to organize information from the data by discovering features that compose multilevel distributed representations. Deep neural networks are typically trained, by updating and adjusting neurons weights and biases, utilizing the supervised learning back propagation algorithm in conjunction with optimization technique such as stochastic gradient descent. Transfer learning is used in many areas of machine learning without retraining the whole system and DNNs are well suited for the transfer learning.

F. Regression Analytics

It is a predictive modelling technique which investigates the relationship between a dependent (target) and independent variable (s) (predictor). This technique is used for forecasting, time series modelling and finding the causal effect relationship between the

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variables. Various types of regression are linear, polynomial, stepwise, logistic regression etc. Thus, embedded methods within our model consist of two types of regression techniques LASSO (L1) and RIDGE (L2) regression where L1 and L2 are regularisation levels. Recursive Feature Elimination (RFE) is also used along with L1 regression but in terms of Area under Curve (AUC) parameter L1 is more stable and accurate.

IV. CONCLUSION

The goal of the present study is to enable a system which could help the disabled and neuro patients control their surroundings using brainwaves

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