



IMAGE RECONSTRUCTION OF EEG DATA USING CONVOLUTIONAL NEURAL NETWORKS

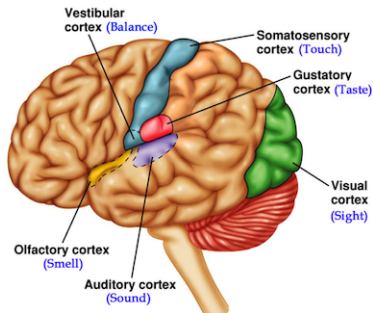
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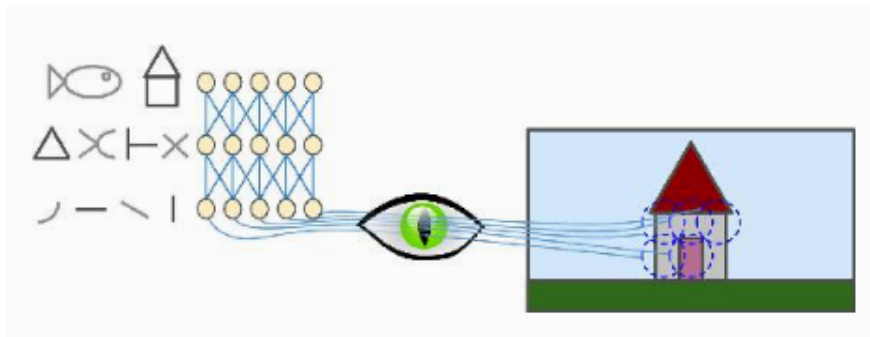
Introduction



- The brain is a highly complex, non linear, dynamic system, with so much still unknown about its structure and functionality.
- Assumed to be divided into 52 local areas where each area is processing a specific type of data.
- Very large part of the brain is responsible for vision and visual processing.

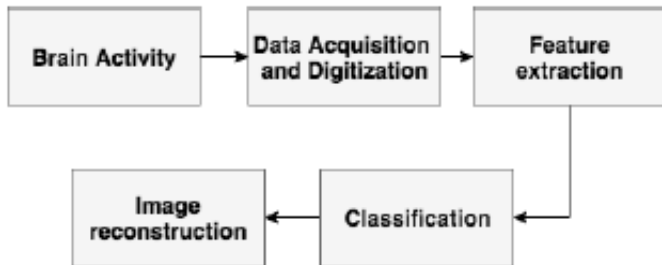
Visual Cortex Archicecture

- Many neurons in VC have small local receptive fields.
- The receptive fields overlap - Together they form the whole visual field.
- Neurons React differently and some have larger receptive fields than other.



Problem Statement

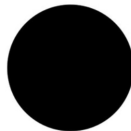
My research project will strive to shed some light on some of these mysteries by reconstructing images as received and perceived by the brain.



Data acquisition and digitization

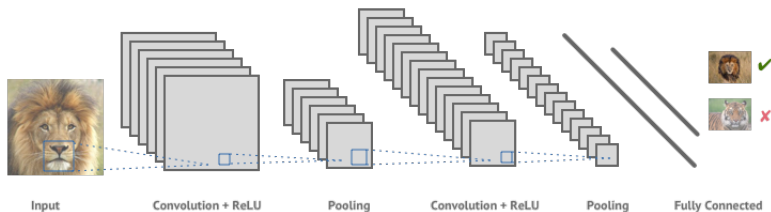
Electroencephalography-EEG

is the study of the brain functions reflected by the brain's electrical activity and is considered one of the basic tools to image brain functioning. Using different methodologies, the signals can be represented as a vector array or matrix array for data processing utilities.



Convolutional Neural Network - CNN

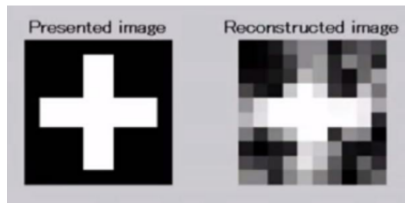
- Hot topic in image reconstruction and speech analysis, having powerful learning abilities.
- It's weight sharing network structure makes it very similar to the biological neural network which reduces the number of weights and the complexity of the network model.
- More sophisticated than prior decision tree algorithms that use rigid if-then rules.



Softmax Classifier

- Very popular in the recognition and classification field.
- Used to encode the higher ordered features into a one dimensional vector.
- Different classes according to their appropriate shape, for example, 0 = circle, 1 = square etc.
- The softmax classifier is trained by minimizing the cost function used to classify the learned features.

Image Reconstruction



The link below gives an example of how the expected results of this research project will look when reconstructing geometric shapes from brain waves. In the example shown in the link, the brain activity was measured by fMRI.

<https://www.youtube.com/watch?v=JHj0xaoW84k&t=13s>

Scan the QR link to get more information on my research proposal.

