Adaptive filters and the retinal processing pattern:
A solution to restore human vision

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1. Project Goals

The Encoded Blue Eyes Project (EBE Project) aims to develop adaptive imaging algorithms capable of re-creating the retinal processing pattern. In addition, propose a robotic device architecture, capable of acting directly in the human brain to restore the vision of people suffering from blindness, a global health problem [1].

2. Methodology

The project intends to overcome the technologies already used in [2] and [3] in the treatment of blindness, as well as to innovate in the proposal of a biocompatible device. EBE Project integrates robotics, computing and neuroscience, bringing an engineering solution to a biological problem.

In the first place, a bibliographical research was done on the main technologies to restore vision, with regard to implants and their computational power, in order to guarantee the differentiation of the device.

In addition, a preliminary study was performed on the role of the human retina in the visual pathway. Based on this, analyzes were developed on edge detection using the tools of the Sci-kit image library, in Python language. Then, tests related to the filters approached for their integration with the machine learning, through the library Sci-kit Learn, also in the Python language.

3. Results

It was possible to determine that gradient operators such as Sobel [4] guarantee greater accuracy and scalability for multiscale systems, allowing their use in the construction of the adaptive filter model to recreate the retinal processing pattern.

It was also possible to observe that the differentiation of the size of the masks contributes significantly to guarantee the best detection and sending to the brain.

4. Conclusion

Determining processing algorithms whose operation resembles the pattern generated by the retina is a task that requires careful analysis of the main aspects of the Detection Theory [5] to understand the computational power demanded. The preprocessing model using edge detection filters to be proposed will take as the north gradient operators in front of their performance.

The next steps of the project aim, in this way, to recreate the pattern of processing of the retina, using the primary detection of borders for composition of the visual map. Thus, guarantee data and patterns recognizable by the human brain. In addition, to promote scalability, better noise handling and relatively low computational power to drive their processing. Finally, the EBE Project will follow in order to implement the scalable detection algorithm to a robotic and adaptive device, to include artificial intelligence in its learning process

.5. References

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