Curiosity Cloning

Neural Modelling for Image Analysis

Executive Summary

Study team members: Touradj Ebrahimi , Ashkan Yazdani, Frederic Dufaux, Thien M. Ha., Dario Izzo, Christos Ampatzis

Research centre(s): Ecole Polytechnique Fédérale de Lausanne and Advanced Concpets Team, ESA

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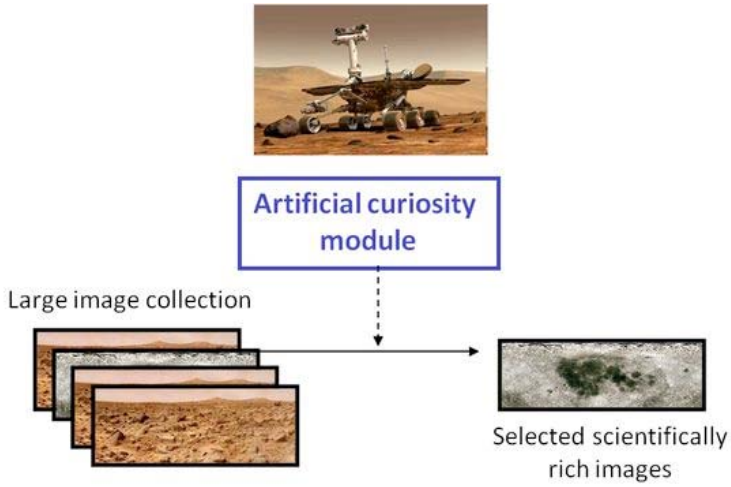
Picture:



Motivation:

The Aim of this research to assess the possibility of retrieval of scientifically interesting images in a large database only by means of processing the brain electrical signal and to explore the neurophysiologic correlates of scientific curiosity.

Methodology:

It has been proven that there exist several patterns in Electroencephalogram (EEG) signal that can be evoked using some specific acquisition paradigm and these patterns are being used currently in the area of Brain Computer Interfacing (BCI) for rehabilitation and multimedia applications. In this research, EEG signal was acquired during several experiments. These experiments were precisely engineered and designed so that the subjects' curiosity and state of being interested is excited. After the signal acquisition phase, signal processing and machine learning algorithm have been used to assess the possibility of detecting if subjects are curious about or interested in a particular image in a large database ad subsequently to retrieve such images.

Results:

The following results have been obtained in this experiment after the processing of EEG signals acquired during the designed experiments.

- It is possible to develop a classification system with a relatively high classification accuracy, which can detect the scientifically interesting images in a large database.

- There is an obvious difference between expert and no expert subjects while watching particular image dataset. In other words, degree of expertise has a significant effect on detection of scientifically interesting images in a large database.

- It is possible to train a classification system for different users and use this classifier when they watch new datasets and extract the scientifically interesting images in the new dataset with an acceptable accuracy.

Publications:

- D. Izzo, L. Rossini, M. Rucinski, C. Ampatzis, G. Healy, P. Wilkins, A. Smeaton, A. Yazdani, and T. Ebrahimi, “CURIOSITY CLONING: NEURAL ANALYSIS OF SCIENTIFIC KNOWLEDGE”, Proceedings of the International Joint Conference on Artificial Intelligence 2009, Workshop on Artificial Intelligence in Space, 2009.

- D. Izzo, M. Rucinski, C. Ampatzis, E. M. Moraud, G. Healy, P. Wilkins, A. Smeaton, A. Yazdani, and T. Ebrahimi, “ On the classification of brainwaves associated to scientific stimuli”, submitted to Machine Learning journal.

Highlights:

In this Research, an efficient P300-based BCI system for classification of brainwaves associated to scientific stimuli was presented. It was shown that relatively high classification accuracies(F-measure values of 0.7 to 0.9) can be obtained for users of this system. It has been observed that increasing the speed of image presentation, will decrease the classification accuracy, however with image presentation frequency of 3.33 Hz, it is still possible to have relatively good classification result.