Data Mining and Information Visualization for Facilitating the Medical Analysis of Patient Movement

Keywords

Big And Heterogeneous Data, Data Mining, Information Visualization, Visual Analytics, Movement Analysis, Medical Analysis

Supervisors

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  His research focuses on **Data Mining**[1,2].
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Scientific domain

Visual analytics is the science of analytical reasoning facilitated by interactive visual interfaces. More precisely, "visual analytics combines automated analysis techniques with interactive visualizations for effective understanding, reasoning and decision making on the basis of very large and complex datasets"[6]. Automated analysis techniques include statistics, mathematics, knowledge representation, management, and discovery technologies. In this project, we focus on combining **data mining** techniques with **information visualization**.

Context

Recent technologies such as Kinect, Wiiboard, Tablet, Joypad, eye tracking devices, etc., enable to record patient's behavior. For medicine, **analyzing this behavior** is a key to **establish efficient diagnostics** and better design recovery good practices. To perform a strong diagnostic, data generated by recording devices (body movements, eye movements, etc.) has to be analyzed

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taking account of the patient background (health problem, personal information, etc.). In this context, therapists are confronted to **large amount of heterogeneous data** and their analyses require automatic methods. The difficulty lies not in generating but rather in sifting through this mass raw of data in order to discover patterns. This thesis focuses on designing **data mining** and **information visualization** techniques to create **interfaces** helping healthcare professionals to understand the data.

Subject

A number of issues associated with the design of such **interfaces** will be examined in the context of this thesis in order to **provide therapists with the tools necessary to perform their analyses** (see for example the recent promising work of Bernard *et al.*[7]). It is of utmost importance that these interfaces be as simple and intuitive as possible, as a misinterpretation of the data due to imperfect interface design could hamper the rehabilitation process. It is for this reason that an in-depth study of knowledge discovery methods must be undertaken by experts in **data mining, information visualization** and **human-computer interaction**, in close collaboration with therapists.

In order to design the interface, we will follow the process described by Tamara Munzner (domain problem characterization, data/operation abstraction design, encoding/interaction technique design, algorithm design)[8]. Each of these steps will be validated using the article's recommendations. Next user testing will be performed to verify the effectiveness of our approach, using the experimental protocols described by Helen Purchase[9].

Partners

We will work in close collaboration with NaturalPad, a company currently developing a platform for therapeutic serious games, and M2H, a laboratory focusing on the study of movements for health.

How to Apply

For additional information about the position, please contact PhD. candidate Juan Antonio LOSSIO-VENTURA, juan.lossio@lirmm.fr. An ideal candidate must be from Peru (**mandatory**), should have a Master's degree (**not mandatory**) in computer science. Also those who are expected to finish their Master's degree may apply. Good programming skills and fluency in spoken and written English and/or French are required. The starting date is negotiable.

Application Deadline

The application deadline is November 5, 2014.

[7] Jürgen Bernard, Nils Wilhelm, Björn Krüger, Thorsten May, Tobias Schreck, and Jörn Kohlhammer. MotionExplorer: Exploratory Search in Human Motion Capture Data Based on Hierarchical Aggregation. IEEE Transactions on Visualization Computer Graphics 19(12): 2257-2266, 2013.
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