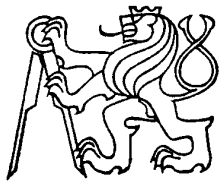

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Project of International Cooperation in the field of Micro-Sleeps

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Abstract:

In this report the project of the systematic research in the field of human subject attention and of the reliability of his/her interaction with artificial system is proposed. The project is considered as a part of wide international cooperation in the field of brain research, organized by the OECG Global Science Forum workgroup "Neuroinformatics". The aim of this project is to contribute to extension of the knowledge in the brain research area especially as concerns the problems of human subject attention and vigilance decrease and micro-sleeps appearing in the course of long dealing of the human subject with any artificial system (especially this concerns the transportation systems). For this purpose it is necessary to provide a waste amount of systematic measurements of many human subject attention parameters and to store the results in wide accessible common database (the Micro Sleep Base – MSB). The realization of these measurements and filling out of the MSB needs coordinated cooperation of many research laboratories. The project proposes how to organize such cooperation.

Content:

1. Introduction

The vigilance, attention and sleep of human being are in the focus of interest of neurologists for more than 50 years already. There exist a considerably huge amount of experimental data, obtained by many researches in various laboratories around the world. However, these data are only rarely mutually comparable and often are only hardly accessible for anybody except its owner.

The contemporary increasing of research activities concerning the impact of human system operator (or user) vigilance and attention reduction appearing in the course of his/her long non-interrupted service (or use) of the artificial system under

consideration underlines the necessity of systematic coordination of these research activities and of sharing the obtained results.

This concerns especially the experimental data representing the stages of the particular human subject brain. A good part of the respective measurements is based on electroencephalographic (EEG) analysis. The respective time-series need to be measured on heads of quite large number of probands (tested human subjects) – probably at least of several thousands - for to be able to make the necessary generalization of the observed dependencies. However, no single laboratory can carry out such amount of measurement alone.

Therefore this project proposes to equip several interested laboratories in various countries, participating on the Global Science Forum of the OECD activities, with appropriate measuring sets. These must be suitable:

to create compatible experimental data,

to coordinate the measurements, which they will realize by standardized methodologies and

to store the obtained results in the commonly accessible specialized database (the Micro Sleep Base - MSB).

2. The Micro Sleep Base (MSB)

The MSB will allow:

- To store the compatible EEG data on human subject attention and vigilance decrease obtained in various laboratories,
- To store the EEG data on human subject sleep procedure,
- To store all the necessary supporting data,
- To derive from these primary data the sets of secondary, derivative data by the application of suitable mathematical procedures,
- To proceed the respective data-mining from the stored data sets,
- To utilize the content of MSB by other authorized research institutions and individuals.

The principal structure and function of the MSB is proposed in [1]. The first version of MSB was already developed in the Laboratory of System Reliability, Department of Control Engineering and Telematics, Czech Technical University, Prague. The methods for finding the hidden

information and knowledge, hidden in large amount of data stored in data-bases (methods of data-mining) are in the focus of interest of many researchers dealing with informatics for long time. Among them a good tool seems to be especially those, based on the GUHA methodology (see [2] e.g.)

3. Project of systematic measurements

The object of measurements, the result of which will be stored in the MSB will be considerably complicated. The human vigilance and attention is very complex phenomenon, for the representation of which various markers (significant parameters) are necessary. While the dominant position among them the EEG signals and the derivatives of them hold, also other markers like the rhythms and frequency of eye movements, the body and breath temperature, the skin resistance, the face shape and grimace etc. are of non-neglectable importance.

For the serious research in the field of human vigilance and attention, like for the improvement of our knowledge in the brain science in general, we need to measure such markers on many human subjects of various age, sex, profession, race and health. Quite preliminary, one can estimate the minimal necessary number of such measured subjects on several thousands.

Because there is no hope that even the most powerful and best-furnished laboratory can itself provide such large number of measurements, we see the only hope how to reach this goal in quite wide, effectively coordinate international cooperation.

However, for such purpose:

- At least a part of measuring methods and tools has to be standardized to ensure the comparability of partial results.
- The information base, i.e. the MSB in this case has to be designed so, that for any measured individual human subject all the relevant data will be selectively stored and that from them the necessary information can be mined.

As concerns the first above-mentioned point, it will be very good, if the interested laboratories or institutes can be equipped with compatible or if possible identical measuring equipments. Unfortunately, the last is hard to be expected because of economic limitations. Nevertheless, the compatibility needs remains. For this purpose the proposal of minimal standard for various kinds of

measurements (the EEG before all) will be prepared and presented for discussion as the first task of the project.

As concerns the eventual cooperating institutions, the interest for to take part on the above mentioned measurements and filling out of the MSB can be expected by the followings:

Laboratories and institutions which interest to contribute to MSB can be expected

Location	Country	Institution	Representative	Equipment
Prague	Czech Republic	CTU, FTS	Prof.Novák	y
Prague	Czech Republic	MAFI	Dr. Valach	
Brno	Czech Republic	MA	Prof. Přenosil	y
Pilsen	Czech Republic	WBU	Prof. Matoušek	
Berlin	Germany	FUB	Dr. Hansen, Dr. Kranda	y
Regensburg	Germany	UR	Prof. Zuley	
Oberpfaffenhoffen	Germany	DLR	Prof. Kortüm	
Paris	France	ISEP	Prof. Sviezeny	
Delft	The Netherlands	TUD	Prof. Rothkrantz	
Innsbruck	Austria	UI	Dr. Telser	Y
Piraeus	Greece	HNA	Prof. Mastorakis	
Siena	Italy	US	Prof. Gori	
Orlando	USA	UCF	Prof. Gelenbe	Y
Tokyo	Japan	Rikken	Prof. Amari	Y
Melbourne	Australia	UM	Prof. Egan	

Here means:

CTU, FTS…Czech Technical University, Faculty of Transportation Sciences

MAFI…Military Air Force Institute

MA…Military Academy

WBU…West Bohemian University

FUB…Free University, Berlin

UR…University of Regensburg

DLR…Deutsches Zentrum f. Luft- u. Raumfahrt

ISEP...Institut Superieur d´Électronique de Paris

TUD…Technical University of Delft

UI…University of Innsbruck

HNA…Hellenic Naval Academy

US…University of Siena
UCF…University of Central Florida
UM…University of Melbourne.
y…the institution has already at disposal the necessary measuring equipment

4. Exploitation of stored data

All the data and information stored in MSB are expected to be opened for wide spectrum of registered users from all the countries participating in the OECD GSF program “Neuroinformatics” for scientific and educational purposes. However, because some of them are of the character of private property of individual subject, the direct publication of such data is allowed only with permission of the particular subject.

5. Financial support

All works concerning the development of MSB and its filling up by results of the respective measurements will be provided under support of the particular OECD country, taking part in the Global Science Forum program “Neuroinformatics”.

6. References

[1]… Novák M., Faber J., Tichý T., Kolda T.: Project of Micro-Sleep Base.
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