Study program „Biomedical and Clinical Technology"
Study branch „ Biomedical Engineering"

## OPPONENT REVIEW OF DIPLOMA THESIS (MASTER PROJECT THESIS)

student: **B.Sc. Jihyeon Seo**
with title: **Bridging the gap between rat and human EEG-fMRI epilepsy studies**

## Evaluation of the diploma thesis reaches the following level:

| | Evaluation criteria of thesis | Points |
|---|---|---|
| 1. | Their objectives and appropriateness of the content structure thesis in terms of a given topic (performance specification). (0 – 30)* <br> *Each part of the award or sentence must have a clear reflection in the processed work. Excellently fulfilled input can be evaluated by the maximum number of points. The ratio in the range of entries that is not properly or fully processed, the evaluation could be accordingly reduced.* | 29 |
| 2. | Theoretical level and the use of available literature in the thesis. (0 – 30)* <br> *Opponent assesses the relevance of the theoretical part of the award, retrieval range and the systematic arrangement of the findings. If prevails verbatim texts, opponent reduces to score 15 points (of course, provided that the copyright holder). The reason for the reduction in the overall evaluation is also inadequate selection of theoretical knowledge, literature and resources.* | 30 |
| 3. | Range of experimental work (SW, HW), applied knowledge and knowledge level processing methodology and conclusions of this work. (0 – 30)* <br> *The maximum number of points can be given a thesis that is suitable for publication. This aspect is particularly in terms of importance to enhance the theoretical knowledge and practical importance. Especially positively evaluated is a model, software product as well as technical implementation. For minor methodological flaws, the assessment can be reduced by up to 5 points. Inconsistency of treatment with theoretical and unclear or not fully professional approach has led to a reduction of at least 15 points. Further downgrades may be granted for the lack of discussion and relevant conclusions. A total of 30 points for a very complex and error-free work, including other activities such as participation in scientific-research project or grant, active participation in the creation of publications, patents and industrial designs can be applied.* | 22 |
| 4. | Formalities and finish thesis (level writing, markings structure of the text, graphs, tables, citations in the text, bibliography, etc.). (0 – 10)* <br> *Opponent evaluates formal requirements in terms of compliance with the rules of writing, theses attributes, i.e. text formatting, structure of the work, a list of references, availability thesis charts and tables, the method of citation. The total points can be reduced for non-compliance of rules by the maximum score of 2 points for each attribute disrespect. Also, for the occurrence of grammatical errors, typos and improper terminology and stylistics is reduced by 2-4 rating points as well. Within the thesis should appear only standard terminology, especially in the English language (must evaluate the ability to express the technical language - 2 points), graphs are formed according to the principles (see tolerance and the influence of statistical processing - 2 points) for graphs and tables are appropriate legends and everything is legible (2 points) and there are followed by the citation rules ISO690 and ISO690-2 (2 point).* | 8 |
| 5. | **Total points** | 89 |

*\* In case of further comments carry on the overleaf*

## Proposal issues for defence

| | |
|---|---|
| 1. | Please explain what GLM model is |
| 2. | Power spectrum distorts the shape of EEG waveforms. Is it not a problem? |
| 3. | Recordings the seizure activity in humans with the scalp EEG cap are quite common. What are the assets of your work? |
| 4. | |

**The overall assessment of the level elaboration of the diploma thesis:**

| A (excellent) | B (very good) | C (good) | D (satisfactory) | E (sufficient) | F (failed) |
|---|---|---|---|---|---|
| 100-90 points | 89-80 points | 79-70 points | 69-60 points | 59-50 points | < 50 points |
| □** | X** | □** | □** | □** | □** |

** - check the appropriate classification level, in the case of evaluation of F (fail), please provide detailed comments

Diploma thesis was evaluated at classification level …**B-very good**….. mentioned above.

## Comments

The aim of the thesis was to examine if the scalp EEG cap can detect epileptic seizures and aid in EEG-fMRI preclinical epilepsy studies. The author also assesses whether the scalp EEG cap for rats is useful as an experimental platform to bridge the gap between preclinical EEG-fMRI epilepsy studies and clinical EEG-fMRI epilepsy studies.

The Magnetic Resonance (MR) compatible scalp EEG cap was designed by the author's research group for simultaneous scalp EEG-fMRI rat epilepsy studies and it was examined whether the scalp EEG cap can contribute to seizures recordings and whether it could help simultaneous EEG-fMRI studies to study functional connectivity of the brain in resting state and during seizures.

For this purpose, the standalone EEG recordings in resting state, functional Magnetic Resonance Imaging (fMRI) and simultaneous EEG-fMRI recordings were done in resting state and in evoked seizures. Kainic acid (KA) was injected to rats intraperitoneally to induce seizures.

The EEG recordings were analyzed to find out whether they could capture seizure activity. The fMRI datasets were analyzed using three different methods which were 10x10 Region of Interest (ROI) correlation analysis, General Linear Model (GLM) analysis and Independent Component Analysis (ICA).

The EEG recordings were able to show the seizures which were seen with repeated sharp waves and peaks in delta and theta frequency region.

The ROI correlation analysis result of the seizure datasets showed increased correlation coefficients but also decreased coefficients compared to the ones of the resting state dataset of the same rat. In addition, the GLM analysis of a seizure dataset resulted in showing the functionally connected brain regions during evoked seizures such as neocortex, cingulate cortex, striatum, corpus callosum and hippocampus.

When the GLM analysis could not show any significant functionally connected brain region for another seizure dataset, ICA was applied to extract the voxels of which their time series were highly correlated.

These findings suggest that the MR compatible scalp EEG cap could be used as a valuable tool

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in rat EEG-fMRI epilepsy studies and could play a role as an experimental platform to bridge the gap between preclinical epilepsy studies and clinical epilepsy studies.

There are 117 references to the literature. The work, experiments, pictures, and the formal prerequisites are of exceptional quality. All specified aims of the work were fulfilled.

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