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Review

(of the Ph.D. thesis elaborated by Ms. Agnieszka Kazimierska, M.Sc., under supervision of both Magdalena Kasprowicz, Ph.D., D.Sc. and prof. Marek Czosnyka, Ph.D., D.Sc. entitled:

"Assessment of cerebrospinal compliance based on analysis of the shape of intracranial pressure pulse waveform")

Introduction

The last few years, a decade or perhaps even more, can be definitely characterized by the extremely rapid growing of processing of different kinds of data. Among them, there is an important part belonging to biological/biomedical data. It is relatively easy to recognize the reason of the mentioned above fact. Without any doubts, this reason can be placed in enormous development of both software and hardware applications in many measuring processes.

Therefore, taking into account mentioned above, it is necessary to clearly emphasize, that the subject, of the presented to review Ph.D. thesis, is far more than just actual. It appears that it will have a lasting effect on the evolution of the art such as measuring processes in biomedicine. Also there must be one fact added – the field of scientific activity in not very common and rather difficult according to my knowledge and experience.

Statistics

The submitted to review and estimation thesis has in total 83 pages divided into 6 chapters and is ended up with a references consisting of 157 positions, which can be treated as very extensive elaboration. The other features of the nicely elaborated thesis are satisfied as well, i.e.

the thesis is equipped with lists of abbreviations and symbols, figures and tables. Therefore, from the pure editorial point of view, I have no doubts that presented elaboration has been performed by well qualified scientific worker with high capabilities giving a very clear impression to the reader. However, there is one thing, which personally I need to mention, which I consider as a serious disadvantage. It refers to the way of constructing references. It is well known that there are 3 basic system of elaborating the set of references, i.e. Oxford system, Harvard system and Vancouver system. Having 157 positions, reviewer is not able to check if all of them are cited in the text and therefore are not redundant. Using professional text editors (e.g. Latex or Miktex) it is possible to present the references together with number, to which there is recall in the text or to put the page number where particular reference is cited. I am not able to guarantee that with presented number of references (157), all of them were cited.

The general structure of the doctoral dissertation uses new possibilities that seem to be setting a certain standard for some time. It is about presenting a doctoral dissertation in the form of a discussion and commentary on already published papers, both in prestigious journals and papers published and presented at well-known conferences on Biomedical Engineering.

I must honestly admit that I am personally a great supporter of this form of preparation of a doctoral dissertation because on the one hand it presents the author's undoubted achievements presented as a neat comment, while on the other hand it is a great help for the reviewer of the dissertation, because only a certain professionalism and erudition of the author remains to be assessed, not a polemic with the reviewers of the published works.

The first chapter entitled: "Review of physiological foundations of cerebrospinal pressure – volume compensation" is divided into 4 subchapters and devoted to the detailed presentation of the introductory review of notations related to the topic of the thesis. It is focused on the individual description of the main features of the normal cerebrospinal fluid (CSF) that fills the cavities of the ventricular system and flows around the external surfaces for the brain. There is a discussion concerning the role of CSF as well as the possible outcomes of pathologies coming out from not normal flow. The presented description is very clear and fully understandable even for the ordinary reader having some basic engineering knowledge. Next subchapter presents more

information concerning intracranial pressure. There is a short discussion on the problem of monitoring as well as components included in the signal under consideration. Subchapter 3 presents very important subject concerning volume – pressure relationship in the intracranial space. My impression is that the Author is sufficiently capable in all the aspects of the problems that may occur. Last subchapter presents assessment of cerebrospinal compliance and compensatory reserve. It is prepared in the professional way including some aspects of spectral analysis. Chapter two entitled: “Aims and hypotheses” presents three aims, which have been achieved considering journal publications and therefore the presented aim may be considered as the proved hypotheses. The Chapter 3 entitled: “Cerebrospinal compliance estimation based on the shape of intracranial pressure pulse waveform” presents in fact the short description of the paper published in *Acta Neurochirurgica* i.e., the journal with IF = 2,816 and presenting both the details and a few conclusions referring to previously discussed problems.

Substantive part of thesis

Apart of the references, which I discussed above, the presented dissertation is edited with the clear signs of professionalism. However, it has to be said that significant part of the chapter 1 has unfortunately a reproductive character because there are information, which are absolutely necessary to make suitable introduction on one hand and well known on the other hand. I have to confess that I spent some time on thinking about different way of necessary details presentation and definitely it is not easy. Therefore, having no alternative to that I am accepting this, as I mentioned already, reproductive character.

The described way of research presentation, gives the reader a very clear image concerning influence of presented to the review thesis in the scientific discipline. There is no single doubt what was done and what was achieved reaching the main three aims of the presented dissertation. Personally, I have to say, with sufficient emphasis, that the area of Ms. Agnieszka Kazimierska research is extremely difficult, as currently available technology involved in the generally speaking cerebrospinal compliance and intracranial pressure measuring processes is on extremely high level. The presented dissertation proves however, that a lot of work still can be done and the future research is really worth to be undertaken.

Critical remarks

It would not be fair to express only positive aspects of the reviewed thesis. Apart of the references, already discussed the disadvantage of the thesis is the lack of clear goals theses establishment. Personally, I am representing so called "the old school" and thus in my opinion it would be nice to end up the dissertation with the sentence that established goals have been achieved and theses proved. As I mentioned before, the Chapter 2 presents aims and hypotheses. This is of course acceptable but it seems to me that better solution to that, described previously in detail as allowed and popular form of dissertation would refer to description of the aims and claiming that proofs of them is included in the published papers. Partial explanation of that disadvantage, providing necessary kindness of the reviewer, can be found in the publications elaborated owing to the research performed inside the thesis. Most of them were published in the high impacted journals and any criticism on that would mean a criticism of their reviewers, which is not wise at all. So, I am not going to do that. Publications are very good and very well elaborated with the clear influence of supervisors. A consequence of that will be below.

Conclusions

Taking into account previously mentioned facts, it has to be clearly and emphatically said that both research and resulting publications produce satisfactory results for the future.

Therefore, my final conclusion is that Ms. Agnieszka Kazimierska fulfilled with oversize usual requirements concerning the quality of elaborated Ph.D. dissertation. Fortunately, the reviewer has been equipped with information concerning the list of dissertation author's publications. All 6 publications, apart of those used as a dissertation, are indexed on WoS database and I hope very soon the bibliometric parameters such as citations and h-index will increase significantly. At the level of application to obtain a Ph.D. degree the scientific achievements of Ms. Agnieszka Kazimierska are far more than just sufficient.

The only possible conclusion, in the light of all the above-mentioned facts is to vote "for" granting to Ms. Agnieszka Kazimierska the Ph.D. degree and this is my recommendation. Additionally, using the privilege of the reviewer, the board responsible for Ph.D. granting procedure may consider to grant mentioned Ph.D. degree with distinction due to satisfaction of

usual requirements referring to important publications published in the highly impacted professional journals. The Author of the dissertation is extremely active having several internships as well international collaboration. She published already 6 impacted publications and 6 peer reviewed conference paper. Also 9 publications have been published at international prestigious conferences and 11 papers have been published at different national conferences. Finally, I am privileged to mention that Ms. Agnieszka Kazimierska has been granted with 9 different awards and distinctions, what in my view proves my previously presented highly positive impression and opinion.

A handwritten signature in blue ink, consisting of stylized, cursive letters that appear to be 'J. R.' followed by a long horizontal flourish.