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Zabrze, January, 15th 2018

Review

(of the Ph.D. thesis elaborated by Ms. Clara Llorens Quintana, M.Sc., under supervision of both Prof. D. Robert Iskander, Ph.D., D.Sc. (Principle supervisor) and David Madrid Costa, Ph.D. (Co-supervisor) entitled:

"Methods for non-invasive measurement and analysis of tear film quality")

Introduction

The few recent years, a decade or even more, can be definitely characterized by the 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. With no doubts, this reason can be localized 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.

Statistics

The submitted to review and estimation thesis has in total 215 pages divided into 3 chapters and is ended up with a references consisting of 271 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 271 positions reviewer is not able to check if all of them are cited in the text and 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 (271), all of them were cited.

The first chapter entitled: "Introduction" is divided into 5 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 tear film appearing on the eye surface. There is a discussion concerning tear film stability as well as the contribution of meibomian glands. The next subchapter presents so called DED syndrome i.e. dry eye disease. There is a classification of that syndrome and discussion concerning DED symptoms and signs. Also the Meibomian glands dysfunction is presented. Next subchapter presents more less similar contents as previous with application of contact lenses and their influence on the tear film. Subchapter 4 presents very important subject concerning assessment of the tear film stability. There is a word about videokeratoscopy and non-contact meibography, both applying image processing to their analysis. Chapter two entitled: "Research summary" presents only two subchapters dealing with tear film assessment using High Speed Videokeratoscopy (HSV) and automated approach to infrared meibography analysis. Finally the Chapter 3 comes, entitled: "Conclusions and future directions" and presenting 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 aim of the presented dissertation. Personally, I have to say, with sufficient emphasis, that the area of Ms. Clara Llorens Quintana research is extremely difficult, as currently available technology involved in the generally speaking eyes measuring processes is on extremely high level. Having many times my eyes checked I would really consider if anything can be improved. The presented dissertation proves however, that a lot of work still can be done and simple socially problem such as contact lenses is in fact extremely difficult from professional point of view. Colloquially speaking, a piece of the glass or artificial plastic in the eye can cause a lot of problems considering visibility comfort for the patient. So, I would like to express the wish that Author of this dissertation will continue that research with great scientific achievements in the future.

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. 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. Clara Llorens Quintana 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 7 publications 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. Clara Llorens Quintana 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. Clara Llorens Quintana 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.