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## **Report on doctoral dissertation**

**Title:** Assessment of Parkinson's Disease Based on Acoustic Analysis of Hypokinetic Dysarthria

**Author:** Ing. Zoltán Galáž.

### **Brief overview of the dissertation**

The dissertation topic is application of quantitative analysis of acoustic signals in early diagnosis of Parkinson disease. As the dissertation covers both medical and signal processing fields, its structure is as follows.

The first two chapters summarize the state of knowledge of Parkinson disease and speech disorders called Hypokinetic Dysarthria. The author gives brief descriptions, conventional diagnostic methods with their limitations and new para-clinical methods. The third chapter then states the objectives of the dissertation.

The fourth chapter describes how to obtain various acoustic features by analysis of speech signals. Then the links between the obtained acoustic features and various symptoms of speech disorder are statistically analyzed.

The fifth chapter studies the links between acoustic features and symptoms describing severity of Parkinson disease. It also presents the results of correlation analysis between Parkinson disease and speech disorder symptoms.

The sixth chapter is oriented to freezing of gait which is one particular symptom of Parkinson disease and how its progress within two years can be predicted by quantitative analysis of speech disorders.

The above three chapters always specify the data set, the analytical setup, and give a rather detailed discussion of the results obtained.

The rest of the thesis is an extensive list of 251 references and the list of author's publications.

### **Assessment of the dissertation topic**

The topic of the dissertation is very up to date and it fully corresponds with the field of Teleinformatics. Moreover, it aims to present novel results on the boundary between Electronics and Medicine to the benefit of both of these fields. So the topic should be considered as a rather demanding one.

### **Contribution of the dissertation**

The most important contribution of the dissertation are new original results in application of the quantitative acoustic analysis of speech signals in detecting symptoms of Parkinson disease at early

stage. Though a detailed assessment of the impacts of the dissertation results on the clinical practice has to be left to medical specialists, it is clear that novel promising results have been obtained. The results thus both stimulate further research in the area and also contribute to future direct application of the computerized speech analysis in clinical practice. In particular, the author has reached a high precision of predicting certain forms of gait freezing in the horizon of two years from articulation abnormalities with error of just about 10%. There are various other results that are well commented and supported by statistical figures.

### **Weaknesses of the dissertation**

As the author applies quantitative computerized analysis of acoustic signals, at least a brief description of the actual hardware and software tools should have been included. For example, the chapter 4.3.1 mentions only the microphone. This can be explained by the fact that author uses the setup routinely and it has certainly been specified earlier. Nevertheless, a new reader would appreciate this information.

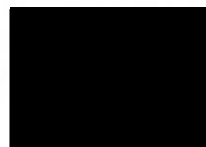
Other less important issues are:

p.35: missing differentials “ $dx dy$ ” in (4.1)

p.37: “+” instead of “-“ in the numerator of (4.4)

### **Summary**

The objectives of the dissertation were reached. The topic is up to date and the results represent an important contribution to the area. The weaknesses are not serious and definitely don't decrease the high quality of the dissertation. The results have been published in impacted journals. The dissertation is written in very good English, the number of typos and minor grammatical issues is minimal.



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### **Suggested question to the author:**

Explaine what do you mean by different units of RMSE and MAE metrics. If physical units are considered, they are the same as variables themselves for both.