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Revision of Bachelor's thesis of Nikita Tishin

The Bachelor's thesis of Mr. Nikita Tishin presents several challenges for a Bachelor student. I would like to remark the following ones:

- The student needed to apply a complex Neural Network model for image processing. In particular for solving classification taks.
- To understand the mathematical concepts behind Convolutional Neural Networks (CNN).
- An additional challange has been to process real dataset.The student transforms the EEG signals using a kind of filter (Recurrence plot) in images. Each image has associated a label related to mental disorders. The student applied CNN for solving this classification problem.

I consider the student well covered the main challenges of this thesis. The thesis is well-organized and it was written using an acceptable scientific writing style. During the project, the student has worked with a high independence. We had regular meetings with certain regularity. The student always showed to me a good disposition and a positive interest in developing new innovative ideas. He applied systematic methodology. The student showed independence in the selected bibliography and he used my suggestions. In addition, he used latex and bib tex during the thesis following the scientific standard of citations. A positive aspect in the thesis is that the student presented his results using several architectures, and he compared the reached results with the state-of-art performances.

However, the thesis also presents some limitations, I would like to remark the folllowing ones:
- Some mathematical notation problems.
- Recurrence plot is defined as a keyword of the thesis, but it is short described in the text.
- Experimental results:
  - It is much better the analisis of the student in the problem of MNIST than in the other ones.
  - Figure 5.9 looks strange for me.
  - It is missing more analysis and discussion about the results related to the EEG data. For example 5.3.3 is very short.

Summary evaluation:

The thesis proposed by Nikita Tishin presents an application of CNNs for classifiying images. He developed the software using well-known packages, and he applied the developed model over two popular benchmark problems and a data containing EEG signals. It is interesting the applied methodology for evaluating the architecture of the model. The student obtained good results. The thesis is well written, the methodology is clear, and the empirical results are acceptable.

I am convinced the document presented by N. Tishin clearly has the level and content according to a Bachelor thesis in the area of Computer Science. I consider that the author shows a good expertise and knowledge in important concepts like: Machine Learning, CNN and image processing, and he showed good skills for developing software. Besides, the student proves good capacities for writing a report following a scientific format. He followed a scientific methodology, and always presented good interest and disposition for working during his thesis. The thesis has some minor weak details related the analisis of the real data. To sum up, I truly believe, and

strongly supports that Nikita Tishin deserves to obtain his Bachelor title in Computer Science with a very good mark. As a consequence, I propose the mark B to this thesis.

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S. Basterrech, PhD