I. IDENTIFICATION DATA

Thesis title:	Vyhodnocení Arterial spin labeling MRI – kalibrace z dat s potlačením pozadí
Author's name:	Prysiazhniuk Yeva
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Computer Science
Thesis reviewer:	Marco Castellaro, Ph.D.
Reviewer's department:	Department of Neuroscience, movement and biomedicine, University of Verona

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment   **challenging**

How demanding was the assigned project?

The thesis is exploring the possibility to retrieve the calibration information needed in an Arterial Spin Labelling experiment, when no M0 was acquired, in correspondence of the use of background suppression (BS) pulses that are tailored to null the net magnetization at the time of read out. On one hand, many clinical studies could potentially benefit from the results of this project, since the M0 image is not always acquired and therefore, in those data set, it is not theoretically possible to obtain absolute perfusion quantification. On the other hand, the possibility to retrieve those information is very challenging since the full net magnetization, from which the calibration factor is estimated can be affected by many factors. In this thesis a first attempt to account for this problem is made, therefore this novel topic respond to a challenging problem to be addressed.

Fulfilment of assignment   **fulfilled**

How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.

The goal of this thesis is to "correct for the signal loss in control images with BS to allow its use as an M0 scan". The thesis explores two possible scenarios (2D and 3D readout acquisitions) in a real data environment. Moreover, it proposes a single tissue method and a more complex multi-tissue model to correct for M0 in ASL data with BS pulses. Finally there is a deep analysis of how the proposed correction impacts not only the M0 estimated but also the perfusion (CBF) estimation process.

Methodology   **correct**

Comment on the correctness of the approach and/or the solution methods.

The thesis is proposing a novel method to account BS pulses in the M0 restoration process. The method is original and novel. The quantitative evaluation of the results in term of both M0 mean square error and of perfusion estimation are correct and well justified.

Technical level   **A - excellent.**

Is the thesis technically sound? How well did the student employ expertise in the field of his/her field of study? Does the student explain clearly what he/she has done?

The thesis explain very clearly the novelty of the work done by the student. The expertise in magnetic resonance imaging and post-processing of biomedical images is well employed and well documented.

Formal and language level, scope of thesis   **A - excellent.**

Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?

The thesis does not require any revision in my opinion. The language is clear and understandable with a sufficient background of Magnetic Resonance physics. The formalism is appropriated and each equation is explained and each figure is well described. The thesis covers extensively the developed project and describes clearly each step.

Selection of sources, citation correctness	**A - excellent.**

Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?

The text is well referenced. The novelty of the thesis is described very clearly.

Additional commentary and evaluation (optional)

Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.

The thesis is a step forward in the recovery of clinical dataset that, up to now, are missing the absolute quantification since the M0 calibration image have not been acquired. I think that this work could be potentially extended. An idea could be to use more novel model of prediction of the data. For example, deep learning methods and in particular Generative Adversative Network approaches could be used to predict the M0 images based on existing data set, starting from background suppressed ASL images. The only aspect that I see that could be potentially a weakness is that the multi-tissue model is not accounting for CSF contamination in the M0 images, but this could be addressed changing the model to use three tissue components.

III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

Summarize your opinion on the thesis and explain your final grading. Pose questions that should be answered during the presentation and defense of the student's work.

The grade that I award for the thesis is **A - excellent.**

Date: **16.6.2021**   Signature: