

Opponent Review of Doctoral Dissertation

Applicant: Mgr. Ing. Pavel Šeda

Title of Dissertation: Optimization of Wireless Networks Infrastructure Using Artificial Intelligence

Methods

Opponent: Assoc. Prof. Sergey Andreev, D. Sci. (Tech.)

Opponent's Department: Unit of Electrical Engineering, Faculty of Information Technology and Communication Sciences, Tampere University, Finland

In accordance with the Study and Examination Rules of BUT, in his/her review the opponent will mainly comment on:

- a) the topicality of the dissertation,*
- b) whether the dissertation achieved its given objective,*
- c) the problem-solving procedure and the results of the dissertation along with the concrete contribution of the doctoral student,*
- d) the significance for practical application or the progress in the field,*
- e) formal and language qualities of the dissertation,*
- f) whether the dissertation fulfils the conditions of Section 47 (4) of the Act,*
- g) whether the student proved his/her creative abilities in the given research field and whether the work does or does not comply with the standard requirements placed on the dissertations in the given field. The review is not valid without this conclusion.*

It is necessary to add a concise commentary to each of the points below.

Ad a) Topicality of the dissertation

The topic of the dissertation is topical.

Comment: The dissertation in question addresses location covering methods that are aimed to facilitate the planning of large-scale cellular systems under various deployment-aware constraints. Given the recent emergence of fifth-generation (5G) mobile network technology, which calls for rethinking such methods by taking into account the advanced radio technology features, the topic of this dissertation is timely.

Ad b) Objective of the dissertation

The objective of the dissertation was achieved.

Comment: The main objective of this dissertation is “to propose and verify a model finding optimal locations for base station densification with regards to the capacity challenges in 5G+ networks” as stated on p. 13. This primary research target and the subsequent research goals (p. 13-14) are comprehensively covered in the text of the dissertation.

Ad c) Problem-solving procedure and the results of the dissertation and the concrete contribution of the doctoral student

The problem-solving procedure and the results of the dissertation are above average.

Comment: The problem-solving procedure within this dissertation comprises the design and numerical illustrations of location covering methods for large-scale cellular systems, which includes algorithmic and model-based considerations with emphasis on artificial intelligence tools. The concrete contribution of the author is systematically demonstrated at the end of Sections 4 and 5 of the dissertation.

Ad d) Significance for practical application or progress in the field

The significance for practical application or progress in the field is above average.

Comment: The application significance of this work is in a dedicated location covering method that is usable under various practical constraints and considerations. The achieved results may aid in the ongoing network densification efforts that are in-line with the development of 5G and beyond systems.

Ad e) Formal and language qualities of the dissertation

Formal and language qualities of the dissertation are average.

Comment: The dissertation generally follows the formal expectations pertaining to its target field. The writing style is however unnecessarily conversational, and the text contains occasional typos, grammatical and notational inconsistencies. Specific author contributions are offered primarily in Sections 4 and 5.

Ad f) The dissertation fulfils the conditions of Section 47 (4) of the Act

The dissertation fulfils the conditions of Section 47 (4)*) Act No. 111/1998 Sb. Higher Education Act: YES

*(*4) Studies are duly finished with a doctoral state exam and dissertation defence, which prove the ability and readiness to work independently in the field of research or development, or in theoretical and creative arts. The dissertation must comprise original and published results or results accepted for publication.*

Ad g) Creative abilities of the student in the given research field. Compliance with the standard requirements placed on the dissertations in the given field.

The doctoral student did prove his/her creative abilities in the given research field and the work does comply with the standard requirements placed on the dissertations in the given field.
Comment: The extent of work completed in this dissertation as well as the associated degrees of novelty and originality are generally appropriate for the subject field of Teleinformatics.

Overall evaluation: The overall evaluation of this dissertation is *above average* in the subject study field.

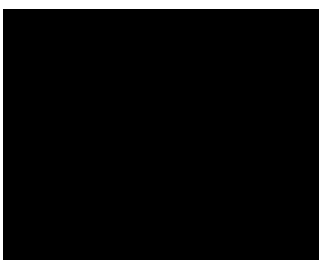
Opponent's questions: The following list of questions can be offered based on assessing this dissertation.

1. In the initial chapters of the dissertation, 5G+ mobile network technology is claimed to serve as research motivation of this study. How exactly the 5G/5G+ technology features warrant and challenge the design of new network planning methods?
2. The problems addressed in this work appear limited to predominantly static formulations. How can the many sources of space-time variability (user/base station mobility, traffic fluctuations, etc.) be considered and the capabilities of the proposed methods be extended?
3. The review of the candidate problem solution algorithms in Section 3 is fairly generic, while it should emphasize the author's perspective and contributions better. When selecting specific solutions, what are the arguments for reasonable time/complexity constraints, such as the technical reasons behind?
4. Section 4 progressively constructs the proposed location covering model. Here, what would be the impact of 5G technology aspects, such as e.g., transmission directionality notably in 3D space?
5. The contributions of Section 5 are in numerical results across various deployment environments. Here, sufficient numbers of simulations were discussed superficially. Was a comparison with other candidate network planning options attempted to arrive at a holistic perspective on the proposed method?
6. The writing of the dissertation is generally appropriate but individual language inconsistencies remain. For the considered optimization problems, the variables over which the optimization is performed are not always introduced as well as the types/ranges of variables (real, binary, etc.) are occasionally missing.

I recommend do not recommend the dissertation for the defence.

Date: 17.06.2022

Signature:



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