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The Dean
Prof. dr hab Andrzej Warczak,
Faculty of Physics, Astronomy and Applied Computer Science,
Jagiellonian University,
Ul. Reymonta 4,
PL-30-059 Kraków,
Poland

Dear Prof. Warczak,

This is a report on the thesis for the degree of Ph.D. of Mrs. Katarzyna Oleś,
entitled “Searching for optimal control strategy of epidemics spreading on
different types of networks”,

This thesis lies at the interface of two areas of research – the study of the spread
of infectious diseases at the population level (infectious disease epidemiology),
and the study of the role of heterogeneous contacts in the transmission of
information (broadly speaking, the role of social network analysis), adding on
the interesting and important consideration of the optimal cost of control.

The thesis contains many features of merit:

- i) The combination of analytical models with simulation to obtain greater insight than can be done with either alone – this requires an important combination of skills indicating advanced development of the candidate’s research potential,
- ii) the development of novel contact structure that effectively capture the key features the candidate wishes to explore, in a parsimonious fashion,
- iii) the integration of simple (but not simplistic) cost-benefit measures, to allow for deeper insight into the relationships amongst population contact structures, disease transmission parameters, and relative costs of palliative and preventive measures, and

- iv) a useful understanding of the limits the abstractions the candidate has used in the models developed, and a clear understanding of ways forward.

The progression across the four published papers that constitute this thesis represent a logical progression of ideas from chapter to chapter, with the candidate making a clear, leading contributions across all four (one of which she is 2nd author on, but the remaining three the lead author). All chapters are published in respected, peer-reviewed journals.

I found particularly interesting the identified relationships between the disease transmission parameters and the development of optimal strategies. Another key finding is the power law relationship between control neighbourhood size, and time to detection and/or treatment (paper 2), a result that has interesting implications and merits further analysis. Papers 1 and 3 are also strong; paper 4 is arguably less substantial, but nevertheless represents a clearly publishable, independent piece of work.

There are some considerations that need to be explored: the literature review does not, in my view, demonstrate an awareness of the more recent extensions in the social network analysis research world that are relevant to the subject the candidate is studying. The relationship between the analytical model and the simulation model in paper 1 needs to be explored more fully, and more broadly, I have some questions as to how generalizable some of the more specific results are. While the candidate does have clear forward directions, a more extensive discussion of the limitations of the inferences that can be made from the approaches the candidate has developed would be useful. However, these are relatively minor points, and do not detract from the clear indicators that the candidate is maturing into a highly competent independent researcher.

In my opinion the presented material fulfills the formal and meritoric criteria required by Polish regulations for completion of the PhD process. On this basis I agree that the procedure of opening the Polish "public defense" for Mrs. Katarzyna Oleś will be granted.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Rowland R. Kao', with a stylized, flowing script.

Rowland R. Kao
Professor of Mathematical Population Biology
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