



UNIwersYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM
W KRAKOWIE

Wydział Farmaceutyczny

757.5100.1.2024

Kraków, 03.01.2024

Review of doctoral dissertation “Cell-type resolution data analysis using different transcriptomics approaches for improvement of current methods” by Elyas Mohammadi, MSc.

Current understanding of the mechanisms governing etiology and development of various diseases includes genetic characterization of the affected subjects, tissues and finally cells as the smallest units of the living organisms. For the latter it is paramount to identify and understand molecular mechanisms responsible for the pathological processes that are the sources of the observed macroscopic effects. Such understanding involves basic mechanisms of cell regulation and a flow of information from genes to the resulting proteins governing certain functions of a cell. There is a long road from understanding to therapeutic applications, yet it has to be started with the knowledge that allows identification of potential therapeutic targets, which requires development of analytical techniques both from wet lab and in silico approaches.

In regard to the above I can only conclude that the topic chosen by Mr. Mohammadi is important and vital for the medical and pharmaceutical sciences if not for the whole civilization in general.

The dissertation presented for the assessment is typical these times, based on the 3 international papers co-authored by Mr. Mohammadi. It is worth mentioning that in two of these papers Mr. Mohammadi is the first Author and the in the third one there are statements of the other Authors pointing to the fragment of the paper contributed by Mr. Mohammadi, which is in perfect alignment with the topic of his dissertation.

Coming back to the structure of the dissertation, it is comprised of the following major sections: List of articles included in the doctoral dissertation, Abbreviations, Abstract (PL/ENG), Summary, References and Publications. The latter contains copies of the publications on which the dissertation was built. The former sections are self-explanatory apart from Summary, which has more complex second-level structure: Introduction, Aims, Materials and Methods, Results and finally Conclusions.



UNIwersytet Jagielloński
COLLEGIUM MEDICUM
W KRAKOWIE

Wydział Farmaceutyczny

In the Introduction Mr. Mohammadi presents current state-of-the-art pointing to the problems required solving, of which some were in fact a major objectives in his dissertation. In particular major topics concerning sources of biological material, concepts of single cell sequencing and major data analyses concepts are presented. This chapter is well structured and demonstrates in-depth knowledge of Mr. Mohammadi on the topic.

Further chapters are more related to the actual work of Mr. Mohammadi starting with aims, methodology and concluding in results and final conclusions. From the technical point of view both language and editorial view of the text are (almost) impeccable. As per my duties of a Reviewer I should point to some technical issues like i.e.:

- on page 24 there is “was introduce” and should be “was introduced”

The above remark is of minor importance and does not undermine any of the achievements of Mr. Mohammadi's work.

The challenge that Mr. Mohammadi took upon himself was to enrich current knowledge and toolbox in the field of single cell transcriptomics. The modesty and in the same time necessity of the steps that were taken are appealing here. I have to say, I hardly ever see such well-balanced scientific maturity at the Doctoral level, which is a great advantage of this work and I should also congratulate Promoter for His perfectly aimed guidance. The major work-line here was to take current knowledge and fill some gaps plus add some steps to the existing techniques for the benefit of achieved results. In the contemporary scientific world, where many people claim their groundbreaking results that allegedly should revolutionize everything we know so far, the approach taken in this dissertation is ... refreshing. Moreover, given my own modeler's background, I am very pleased to see that Mr. Mohammadi puts a lot of emphasis to the fact that in the empirical modeling data quality is crucial. He demonstrated that understanding possible deficiencies of gathered data is what makes the results reliable when properly addressed. Moreover, he was able to find, learn and apply software tools for his work. Additional advantage of this work is publication of the code on GitHub, which makes it re-usable and also a subject of scientific discussion. However, in this moment I have to say that the code published is for demonstrative purposes only – one cannot run it without exem-



UNIwersYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM
W KRAKOWIE

Wydział Farmaceutyczny

plary data. Lat but not least, Mr. Mohammadi proved that he is capable of working in the large interdisciplinary groups in order to achieve sound scientific results.

For the sake of scientific discussion during the defense I wanted to raise following topics:

1. I couldn't find the source of the term "Consecutive Slices Data Integration" in paper I. The work of Stuart et al. cited in the dissertation doesn't introduce the name of the method used here – it is in fact Seurat (v3?) as I see it in the published code. Could I ask for a comment on the source of terminology here?
2. Regarding the above what was the rationale of using dimensions parameter 30 in the dimensionality reduction procedure (RunUMAP)? Any particular reason for such value?
3. Are there any plans to develop an already published code on GitHub into a complete tool?
4. In the paper III "Improvement of the performance of anticancer peptides using a drug repositioning pipeline" there is only a demonstration of a potential for improvement as the structures proposed to enhance anticancer peptides' therapeutic action. Was there any progress in the experimental confirmation of any of these findings?

In conclusion, I find this dissertation fulfilling all requirements of Polish law *art 187 ust. 1 i 2 Ustawy z dnia 20 lipca 2018 r. Prawo o szkolnictwie wyższym i nauce (Dz. U. 2023 r. poz. 742 z późn. zmianami)* for doctoral dissertations. In particular Mr. Elyas Mohammadi achieved an original solution of the scientific problem he solved and therefore it is my recommendation to the High Council of Pharmaceutical Sciences of Medical University of Gdańsk to allow him to take next stages of the procedure to obtain his Philosophy Degree in pharmaceutical sciences.


Prof. dr hab. Aleksander Mendyk