Skoltech
Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Aleksandr Rubashevskii

PhD Program: Computational and Data Science and Engineering

Title of Thesis: Efficient active learning and fact-checking via predictive uncertainty quantification for natural language processing

Supervisor: Assistant Professor Maxim Panov

Name of the Reviewer: Ekaterina Artemova

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	**Date: 18-10-2024**

Reviewer's Report
The primary focus of this thesis is the development of methods for uncertainty estimation, with applications to two key areas: (i) the active learning paradigm, where uncertainty guides the selection of batches for further labeling, and (ii) fact-checking, where the uncertainty of a text generation model can signal the production of inaccurate facts. The first contribution is in active learning methods, specifically the introduction of an efficient algorithm, *Large BatchBALD*, for querying batches of data for labeling. This method is evaluated on three standard datasets for text classification, encompassing tasks such as sentiment analysis, topic classification, and acceptability classification. The second contribution is the development of the *Claim-Conditioned Probability* method for fact-checking, which incorporates token-level uncertainty. This method operates independently of external knowledge, leveraging the generator's probabilities to outperform several baselines and achieve performance comparable to *FactScore*, a metric that relies heavily on external tools. Building on this line of research, the thesis also introduces several tools to support fact-checking experiments. These include frameworks for annotating factuality and a benchmark dataset labeled in accordance with the proposed framework. This thesis comprises an abstract, a list of publications, and six chapters, including an introduction, detailed descriptions of the contributions and experiments, and a conclusion. The total length of the thesis is 121 pages, with an additional 5 pages of appendices. The reviewer particularly appreciated the inclusion of links to GitHub repositories, which host the implementations of the proposed methods.

The publication record is strong, comprising four papers published in Core A/A* conferences (SIAM, EMNLP Demo Track, ACL Findings, and EMNLP Findings). In addition to these four papers, the candidate contributed to two more peer-reviewed publications, demonstrating their ability to contribute to an ML research group beyond their own PhD topic.

Strengths of the thesis

1. Two methods for uncertainty estimation are developed and applied to active learning and fact-checking tasks.
2. The proposed methods demonstrate computational efficiency by either requiring less computational resources or avoiding reliance on external knowledge sources.
3. The experimental setup encompasses a diverse range of tasks in active learning experiments and a variety of languages in fact-checking experiments.

Additional notes

1. The contributions and future work directions are thoroughly discussed in the thesis. However, it would be valuable to include a note on the limitations of the proposed methods.
2. Since the candidate has contributed to papers with 10+ authors, it would be helpful to detail their specific contributions to these works.
3. Additionally, given that two of the main papers were published some time ago, a retrospective discussion of these works would be appreciated. What has changed since then? How has the ALToolBox been received by the community?

Provisional Recommendation
X *I recommend that the candidate should defend the thesis by means of a formal thesis defense*
☐ *I recommend that the candidate should defend the thesis by means of a formal thesis defense only after appropriate changes would be introduced in candidate's thesis according to the recommendations of the present report*
☐ *The thesis is not acceptable and I recommend that the candidate be exempt from the formal thesis defense*