![Skoltech logo](Skoltech - Skolkovo Institute of Science and Technology)

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Evgenii Baraboshkin

PhD Program: Petroleum Engineering

Title of Thesis: Automated core description based on computer analysis

Supervisor: Professor Dmitry Koroteev
Co-supervisor: Dr. Denis Orlov

Name of the Reviewer: Sergey Stanchits

I confirm the absence of any conflict of interest	
	Date: 20-12-2022

The purpose of this report is to obtain an independent review from the members of PhD defense Jury before the thesis defense. The members of PhD defense Jury are asked to submit signed copy of the report at least 30 days prior the thesis defense. The Reviewers are asked to bring a copy of the completed report to the thesis defense and to discuss the contents of each report with each other before the thesis defense.

If the reviewers have any queries about the thesis which they wish to raise in advance, please contact the Chair of the Jury.

Reviewer's Report

Reviewers report should contain the following items:

- Brief evaluation of the thesis quality and overall structure of the dissertation.
- The relevance of the topic of dissertation work to its actual content
- The relevance of the methods used in the dissertation
- The scientific significance of the results obtained and their compliance with the international level and current state of the art
- The relevance of the obtained results to applications (if applicable)
- The quality of publications

The summary of issues to be addressed before/during the thesis defense

In his PhD thesis, Evgenii Baraboshkin presented a new method for applying the convolutional neural networks for a characterization of geological images of rock samples. I consider the topic of the study important, because presently in most cases, the description of core samples is based on a description performed by experts, which is a time-consuming process. The method developed by Evgenii was tested on various datasets, demonstrating the accuracy of automated description up to 95% in comparison to human analysis performed by geologists. It has also been demonstrated that developed algorithm shows better results than the most "traditional" automated algorithms, which often fail to perform an outstanding description that would be at least slightly comparable to human analysis done by experts. I would like to emphasize that the developed algorithms allows speeding the description process up to several times in comparison with the analysis performed by geologists.

The thesis is well-written, text contains 127 pages. The thesis consists of eight chapters, including a literature review, a detailed overview of various methods, the process of dataset preparation and classification, followed by conclusions and recommendations for a future research. The content of the dissertation and the implemented algorithm are fully consistent with the topic of the Ph.D. study, and obtained results are significant.

I have a few comments related to the text of the PhD thesis.

➢ On Page 17 of PhD Thesis, the following is written: "*A reliable and precise description is essential…*", and usually reliability of classification depends on the experience of qualified geologists. How flexible is the developed algorithm for farther improvements? Is it possible in the future to take into account some additional recommendations of geologists that could potentially increase the accuracy of performed classification?
➢ Can some additional lithological information obtained from a well logging be incorporated in the core description process? How this information could be included into classification?
➢ Have any attempts been made to perform averaging of classification results? If so, what was the effect of averaging on the results of classification?
➢ How do the quality and resolution of analyzed images affect the classification results?

Evgenii Baraboshkin has presented the results of his PhD study at six International and two Russian conferences, as well as in two papers in the Q1 ranking journal. Evgenii is also a first author of a patented method for automated description of rocks. To summarize the above, I believe that the candidate is definitely qualified to receive a Ph.D. degree.

Provisional Recommendation

☒ *I recommend that the candidate should defend the thesis by means of a formal thesis defense*