THESIS SUPERVISOR'S REPORT

I. IDENTIFICATION DATA

Thesis title:	The NeRF Utilization in Dense Reconstruction
Author's name:	**Jakub Sakař**
Type of thesis :	bachelor
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Cybernetics
Thesis reviewer:	Ing. Michal Polic
Reviewer's department:	CIIRC CTU in Prague

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	**challenging**
How demanding was the assigned project?	

This project is demanding and complex, as it requires a deep understanding of advanced concepts in machine learning, computer vision, and graphics, specifically those related to Neural Radiance Fields (NeRF) and associated methods. It necessitates strong programming and mathematical modeling skills to implement, test, and optimize the techniques involved.

Fulfilment of assignment	**fulfilled**
How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.	

The thesis effectively fulfills the assigned task, covering all mandatory points, and successfully integrates the DS-NeRF loss function into the Mip-NeRF method. Importantly, the student discovered that the KL-divergence loss function from DS-NeRF resulted in corrupted outcomes. In response, the student derived a novel version of the KL-divergence loss function, which led to improved results on synthetic datasets. This correction, addressing an issue identified in a CVPR 2022 paper, constitutes a valuable contribution. Thus, the thesis not only achieved its primary goals but also demonstrated a proactive approach to problem-solving and a significant scholarly contribution.

Activity and independence when creating final thesis	**A - excellent.**
Assess whether the student had a positive approach, whether the time limits were met, whether the conception was regularly consulted and whether the student was well prepared for the consultations. Assess the student's ability to work independently.	

The student demonstrated a positive attitude and effective time management skills. We held regular consultations in the form of weekly meetings and reading groups, which the student consistently attended and contributed to with well-prepared inputs.

Technical level	**B - very good.**
Is the thesis technically sound? How well did the student employ expertise in his/her field of study? Does the student explain clearly what he/she has done?	

The thesis is technically sound, demonstrating a depth of work that surpasses typical bachelor's degree expectations. The student's expertise is clearly evidenced throughout. However, a few mistakes were observed, such as incorrect notation in equation 2.21, where $\cot(\theta)$ should be $\cos(\theta)$, an unclear index in equation 3.10, a misinterpretation in the description of parameters (e.g., on page 13, "t" should be clarified as defining the 3D point position, not just the ray position), and a missing reference on page 10 for the image coordinate system.

Formal level and language level, scope of thesis	B - very good.
Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?	
Despite minor errors in notation and their explanation, the thesis exceeds the standard typically expected from a bachelor's student. The thesis is logically organized, and the included descriptions and code serve as a comprehensive guide for replication and further research. The quality of the language, including English usage, is commendable, with only a few minor issues. This makes the thesis clear, understandable, and highly readable.	

Selection of sources, citation correctness	A - excellent.
Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?	
While the thesis doesn't encompass all the publications in the burgeoning NeRF-based field, it does reference prior work adequately, particularly those specified in the assignment's scope. In addition, the student proactively incorporated recently published work that emerged during the thesis development, such as NeRF-360, demonstrating a commendable engagement with current research trends.	

Additional commentary and evaluation (optional)
Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.
No additional comments.

III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

The thesis demonstrates an excellent understanding and application of NeRF-based methods, with the student going beyond the assignment's scope by proactively addressing and rectifying an issue in the DS-NeRF's derivation of the KL-divergence loss function. Despite minor errors in notation and explanations, the technical soundness, clarity, and depth of the thesis exceed the expected standard for a bachelor's student. The student exhibited remarkable independence and problem-solving skills, while also maintaining effective time management and regular consultation. Based on these considerations, my final grade primarily reflects the student's proactive and independent problem-solving abilities, as well as their valuable contribution to the field through the correction of a CVPR 2022 paper.

The grade that I award for the thesis is **A - excellent.**

Date: **29.5.2023**   Signature: