THESIS REVIEWER'S REPORT

I. IDENTIFICATION DATA

Thesis title:	**Scene optimization for RTX**
Author's name:	**Tomáš Bilák**
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Computer Graphics and Interaction
Thesis reviewer:	Ing. Martin Káčerik
Reviewer's department:	Department of Computer Graphics and Interaction

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment **ordinarily challenging**

How demanding was the assigned project?

The assignment requires a basic understanding of the BVH construction process and its integration in the hardware accelerated API, such as OptiX.

Fulfilment of assignment **fulfilled with minor objections**

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.

Methodology **correct**

Comment on the correctness of the approach and/or the solution methods.

I consider the chosen approach correct, although the description and the realization could be greatly improved.

Technical level **D - satisfactory.**

Is the thesis technically sound? How well did the student employ expertise in the field of his/her field of study? Does the student explain clearly what he/she has done?

Key decisions for used algorithms are barely explained, missing any hypothesis or motivation. The results are not discussed properly, and their presentation is rather confusing.

Formal and language level, scope of thesis **D - satisfactory.**

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?

In my opinion, the text lacks cohesion. Terms and concepts are introduced in unexpected places or not at all (overlap metric, "SoM thresholds", scene animations, etc.), forcing the reader to jump from place to place or make assumptions. English level is good, slightly degrading towards the end of the text.

Selection of sources, citation correctness **C - good.**

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?

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.

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

Summarize your opinion on the thesis and explain your final grading. Pose questions that should be answered during the presentation and defense of the student's work.

In this work, the student explores the possibilities of scene preprocessing to improve the performance of GPU-accelerated ray tracing. Firstly, the concepts of ray tracing, acceleration structures, and the design choices regarding their implementation in the hardware API are introduced. Then, a brief explanation of previously published optimization methods is given. Finally, a set of four scene preprocessing methods is proposed and evaluated in one unified framework, based on the OptiX wrapper library sample.

While the theoretical section of the thesis is handled relatively well, it cannot be said about the following sections.

Section 4 describes the core methods used for the scene optimization on about two pages while dedicating about seven pages to a description of GUI, visualizations, and benchmarking automation. Due to the nature of the assignment, the ratio would be preferably inverted, comprehensively explaining the core methods with supporting images and references to previous theoretical sections to explain the choices.

Section 5, the evaluation, is quite disarranged, and I feel like the discussion gives more questions than answers.

To conclude, it seems that some useful work was done and the results hint that explored methods might lead to a practical algorithm. However, in the current state, it is not ready. Additionally, the thesis itself does in my opinion a poor job explaining the ideas and results.

The grade that I award for the thesis is **D - satisfactory.**

Questions:

1. As there is little to no information regarding the animated scenarios in the text, can you provide some general information, such as: What are the main challenges of static vs. dynamic scenes w.r.t. BVH? What is the nature of the evaluated animation? Is the API configured differently for static and dynamic scenes? Is the top level AS rebuilt for each frame, or is the refit utilized?
2. Based on the reported times, your optimization techniques introduce preprocessing overhead in seconds, or even minutes, which is a trade-off hardly acceptable for interactive applications. Is this overhead inherent to these methods, or is it due to suboptimal implementation? How could it be improved?
3. The reduction provided by the "Overlap reduction" method is not evaluated. In fact, in Section 5.2 it is explicitly stated that the overlap is inflated, although still improving the performance. Is this an outlier? What is the relationship between the performance and the overlap metric based on your measurements?

Date: **5.6.2024** Signature: