Tomas Bata University in Zlín
Faculty of Applied Informatics

OPPONENT´S EVALUATION OF THE MASTER´S THESIS

Student: **Cong Thuan Nguyen** **Opponent:** **Assocc. Prof. Martin Kotyrba, Ph.D.**

Study program: **Information Technologies**
Study course/Specialization: **Software Engineering**
Academic year: **2023/2024**

Master's Thesis topic: **Road Segmentation in Single View Images**

Evaluation of the thesis:

This thesis addresses the enhancement of road segmentation in single-view images by leveraging deep learning and transfer learning methods. It critically analyses current state-of-the-art segmentation techniques, identifies challenges under diverse environmental conditions, and explores how deep learning can improve algorithm robustness for feature extraction and pattern recognition. By using state-of-the-art datasets, the research aims to evaluate the effectiveness of these models in real-world scenarios, particularly for safety driving functionalities.

The primary aim of this thesis is to advance road segmentation techniques using deep learning models to achieve better accuracy and robustness in single-view images. The research specifically focuses on comparing U-Net with VGG16, FCN, and regular U-Net models and evaluating the performance of these models in different environmental conditions.

The thesis is well-structured, beginning with an introduction to artificial intelligence, deep learning algorithms, and neural networks. It provides a detailed overview of the segmentation models used, including U-Net with VGG16, FCN, and regular U-Net models. The methodology, including the tools and datasets used for experimentation, is clearly explained. The thesis concludes with a summary of findings and potential future improvements. Thesis contains everything I would expect from a computer scientist's thesis, well-explained text accompanied by pictures and source code with commentary. The work contains and works with 49 sources of literature, which it cites correctly. I have only one negative comment about the images quality.

Thesis brings new interesting results and these are following. FCN performs well in simpler scenes, segmenting roads effectively, but struggles with distant features and sky areas due to high parameter size and slower processing speed. U-Net excels in urban settings, capturing smaller objects and complex scenarios, but has limitations in predicting traffic signs and objects near pavements. When we combine U-Net with VGG16 offers a balanced performance, maintaining accuracy in real-life scenes with minimal distortion and fast prediction capabilities compared to FCN. All models show similar overall accuracy with differences in specific strengths and weaknesses. The study emphasizes the importance of model parameter sizes, processing speeds, and robustness in real-world applications.

Questions for defense:

1. What specific data augmentation techniques and model tuning methods do you propose for future research?

2. How do you envision integrating LiDAR data with single-view camera images to enhance model performance?
3. Can you elaborate on how different environmental conditions (e.g., weather variations) affected model performance?

The thesis demonstrates a thorough understanding of road segmentation challenges and provides a solid foundation for future research. Overall, the thesis provides significant insights into the enhancement of road segmentation techniques, contributing towards the development of safer and more efficient autonomous navigation systems therefore I recommend this thesis for defense and I evaluate

Overall evaluation of the thesis:
The Opponent shall grant a mark according to the ECTS classification scale:
A – Excellent, B – Very Good, C – Good, D – Satisfactory, E – Sufficient, F – Insufficient
An “F” grade also means "I do not recommend the thesis for defence."

I recommend this thesis to be defended and suggest the following evaluation:

A - Excellent

In the case of an evaluation grade of “F – Insufficient”, please supply the main shortages and reasons for this assessment.

Date: 24.05.2024 Thesis Opponent's Signature: