Univerzita Tomáše Bati ve Zlíně
Fakulta multimediálních komunikací

Oponentský posudek k disertační práci

Jméno a příjmení studenta	MgA. Marcel Legindi, DiS.
Studijní program	Výtvarná umění
Obor	Multimédia a design
Název disertační práce	Efficiency of Creation in Digital Audiovisuals: The Concept of Non-Linear CGI-AV Pipeline
Autor posudku	prof. Ing. Zuzana Komínková Oplatková, Ph.D.

Dle článku 52 Studijního a zkušebního řádu UTB se oponent v posudku vyjádří zejména:
- k aktuálnosti tématu DP
- se splnění cílů stanovených v DP
- k postupu řešení problému a k výsledkům DP s uvedením konkrétního přínosu doktoranda
- k významu pro praxi nebo rozvoj vědního či uměleckého oboru
- k formální úpravě DP a její jazykové úrovni
- k publikační či umělecké činnosti doktoranda

Relevance and currency of the chosen dissertation topic

The PhD student has selected the topic of current importance with respect to help small studios and freelancers improve their role in the art industry by providing deep insight into the efficiency of creation in digital audiovisuals and creating a concept of non-linear CGI-AV pipeline.

I have to say that I enjoyed reading the thesis since it covers an interesting topic with a clear line from the beginning to the end. The reader knows the aims that are reminded and supported by relevant results or ideas within the whole text.

Definition and fulfilment of the dissertation objectives

The author has proposed primary and secondary goals within proper research questions related to the main aim of the thesis – to create a new concept of non-linear CGI-AV pipeline together with efficiency formula development. All proposed ideas were elaborated properly with the theoretical frame, experimental part and practical part.

Methods of dissertation preparation

I appreciate that the student used the latest techniques, including tools with artificial intelligence incorporated (e.g., for text extraction from video, the Beey.io tool). The thesis also incorporates some technologies from the field of programming languages and software engineering, such as Agile and Scrum methodologies and node-based systems derived from object-oriented programming.

The student has developed the formulas for efficiency computation; however, when reading p. 74 and reading text about the Tool-formula efficiency, one does not know what one iteration is or how it could be defined. The answer can be found within the practical part later and is fully elaborated since it is not easy to define by a simple sentence. From my point of view, the author could also refer to the iteration description on page 74, not only later in the thesis. Even though it is debatable whether Tool-formula efficiency serves correctly since it is unclear what one iteration is and how much time it takes. Some questions about this topic are given in the Questions to defence section.

In the experimental part, the author suggested a linear regression technique as an approach to model the differences between two images since SSIM or PNSR did not work correctly and had higher errors. The linear regression approach belongs to data science for sure and is used quite often because of its easy implementation and interpretability. But this statement might look a bit funny: "Linear regression represents the most basic form of artificial intelligence as we currently understand it - for instance, as seen in GPT models. While it is not a neural network or advanced GPT model, linear regression serves as a foundational tool for understanding how a dataset and the desired outcomes are related through calculation." The truth is that it helps to predict values in regression models. But I would not compare it with GPT models, which serves for different tasks.

In the future, the author could try to use the support vector machines (regression) technique since it may perform better during the training and achieve better results than linear regression. I appreciate clear steps, descriptions and ideas developing in the whole thesis. I only disagree that the student used Median in Excel as function average() on page 97. Median and average are different issues. Most probably, the student meant the mean instead of the median, as it is written correctly in Tab. 8.1.

Achieved results of the dissertation and evaluation of the work in terms of contribution of new knowledge, contribution to practice or art field

The proposed non-linear concepts developed by the author take into account some approaches from different fields, e.g. programming pipelines, Agile and Scrum methodologies from software engineering approaches, and artificial intelligence techniques into account. I appreciate the connection between the latest methodologies from other fields applied and extended into the proposed innovative way of Non-Linear CGI-AV Pipeline, which exists in the blueprint diagram capable of serving for further developing of one software solution, including all the suggestions in one environment in future.

The student also developed formulas for efficiency computation, which can help small studios and freelancers adopt it during the preparation of their projects. The author identified the relationship between quality, efficiency and iteration in this part.

Evaluation of the formal aspects of the thesis, including characteristics of the selection and use of sources

The thesis contains 216 pages with sections such as Introduction, almost 8 pages related to aims and research questions, which are deeply elaborated, Terminology descriptions and the Current state of the industry technologies. 7th chapter is related to the Theoretical part, which serves partly as an experiment itself with the development of the formula for efficiency. Experimental and practical parts in the following sections support the given ideas in the aims and research questions. Chapter 10 discusses the results and is followed by the Contribution of the work and

Conclusion in chapter 12. The thesis also contains a list of figures, tables and used literature together with appendixes and the professional biography.

The thesis is written in English with a high level of used language. The text flow is smooth and very enjoyable for the reader. The images are of the required printing quality. In some parts of the thesis, the reference crosslinks are missing (Error! Reference source not found. – p. 36, p. 106).

I am also missing the usage of references in chapter 5.3. for used methods such as SSIM or DeepAI. They are used in chapter 8, but in my opinion, they could be used within the first "description" of the methods too; Deep AI can be treated in different meaning in the short description on page 39, mainly if there is a brief connection to CNN which might be „misleading" in the sense of meaning - broader group of techniques or one concrete.

I would suggest the numbering of equations/formulas in the text for better readability and usage in the later text as a reference similar to literature sources.

I would recommend better colours to differentiate different techniques in Fig. 8.18. It is hard to follow the results achieved in it.

Mentioned minor issues does not decrease the quality of the whole thesis.

Publication or art activities of the student.
The publication fulfils the standards given in the field of study.

Questions to the defence.

1. On page 35, it is written: "For the broader focus group, the survey link was published through the public Instagram profile of the Miss Czech Republic 2020, who reaches more than 50K subscribers." Do you know Miss Czech Republic 2020 personally?

2. On page 37, What is meant by extreme in a sentence: "method for defining the image differences by three techniques based on mathematical extremes". SSIM and PSNR do not compute any extreme in the sense of optimisation.

3. In Fig. 7.2. – if the tree is generated by two different software – will both output images really be the same? Are they randomly generated? Are those approaches then comparable? Of course, the time demands are visible with respect to whether a button or a slider is used. The question was whether the complexity of the tree would not "influence" the output result too. It is also unclear if creating 5000 leaves is meant as one "task" – one "iteration" in one software. And if creation of the trunk of the tree, another task, will be faster in another environment. Do you recommend jumping between software? Will the time spent on exporting and preparing for the other environment not be more time-consuming? Could you explain this during the defence, please?

4. Could you also suggest how to treat the efficiency values for someone who is at the beginning of the task? If he or she tries the "task" in different software, it does not help to improve. Do you suggest measuring the efficiency by the software companies and publish them? Or how do you suggest the freelancer or small studio should take advantage of the (possibly) computed efficiency values?

5. It is not clear how the data were taken for linear regression. In SSIM – you compare two images and get the score in an "objective" way. In linear regression, if I understand well, you "try" to model the perception of the average person obtained from the questionnaire, i.e. 156

respondents. Am I right? Will this work if you increase the number of people who take the questionnaire? Will the model be the same? I am also lost with the error computation in Table 8.5? *Error from the existing computation techniques.* Will it change if you increase the number of respondents for the questionnaire? Could you explain this during the defence?

6. I am lost with numbers for Deep AI in tab. 8.3., p. 109. As far as I know, values should be between 0 and 1. Therefore, values more than 1 do not make sense. Or could you explain what these numbers represent?

7. What does 1e6 means in Fig. 8.17?

Conclusion

MgA. Marcel Legindi, DiS. proved the ability of creative and inventive scientific and art work. The dissertation fulfils the standard requirements in the given field which includes also interdisciplinary ideas.

Therefore, **I recommend** the candidate to be awarded with the Ph.D. degree.

In Zlín, 30th May 2024

prof. Ing. Zuzana Komínková Oplatková, Ph.D.
                m.p.

Department of informatics and artificial intelligence
Faculty of the Applied Informatics
Tomas Bata University in Zlín
Nad Stráněmi 4511
760 05 Zlín