FACULTY
OF INFORMATION
TECHNOLOGY
CTU IN PRAGUE

Supervisor's statement of a final thesis

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Student: Přemysl Pilař
Thesis title: Co-evolutionary approach to symbolic regression
Branch / specialization: Knowledge Engineering
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Evaluation criteria

1. Fulfillment of the assignment

[1] assignment fulfilled
▶ [2] **assignment fulfilled with minor objections**
[3] assignment fulfilled with major objections
[4] assignment not fulfilled

The thesis assignment was rather challenging for a bachelor's thesis, requiring a deep understanding of methods that are not a part of the knowledge acquired in the study program's courses. Given the complexity of the assignment, I would evaluate all four tasks as fulfilled, some of them with certain objections. The strength of the work is the fully functional implementation (Task 2), which forms the core of the thesis. This demonstrates that the candidate understands the used symbolic regression method well. However, while the baseline method choice was appropriate in the context of the assignment, it is not sufficiently justified in the text (Task 1). The fitness function design (Task 3) and the methods for maintaining population diversity (Task 4) have been both tackled in the thesis, but a more detailed discussion would be welcome.

2. Main written part   70 / 100 (C)

The thesis presents an approach to co-evolution in symbolic regression, including a brief introduction, a broad theoretical background, a description of the method and its components, and experimental results, finished with a concise conclusion. It is written in relatively good English with occasional typos, grammar errors, and inconsistencies. The content features useful code listings, figures, and tables. The references are appropriate and the candidate follows good citing practices, with a small exception for a few errors in some references, e.g., the authors' names in [11-14]. The formal notation used in the thesis is overall correct. The organization and structure of the thesis could be certainly improved to connect the individual parts better to each other and make the text easier to comprehend. The theoretical background could be more focused as it explains principles not always relevant to the topic. The clarity of the method explanation could be improved.

My main objection is that the experimental evaluation is missing a broader discussion of the presented results.

3. Non-written part, attachments 95 /100 (A)

The candidate has shown excellent programming skills by understanding and extending a complex software package for Single Node Genetic Programming (SNGP). His task was to modify the existing code to implement the co-evolution approach. This extension was non-trivial and required a substantial amount of trial-and-error development to make the method work. As a result, the candidate delivered a fully functional code implementing the proposed novel co-evolution method for SNGP, not yet described in the academic literature. The software package together with the detailed experiments configuration presented in the thesis make the empirical evaluation reproducible, thus following the best practices of research work.

4. Evaluation of results, publication outputs and awards 70 /100 (C)

The results show that the proposed method is able to find analytic models representing the data given for the problem at hand. The method of co-evolution in SNGP in this form has not been published yet, which could be a great contribution especially if compared to appropriate alternatives. Unfortunately, the experimental evaluation presented in the thesis is missing important insights and a discussion of the results. It is limited to defining the problems and showing the results in the form of tables and plots, restricting the explanation of the results to just a couple of lines.

5. Activity of the student

    [1] excellent activity
  ▸ [2] **very good activity**
    [3] average activity
    [4] weaker, but still sufficient activity
    [5] insufficient activity

The candidate has been prepared for the meetings in most cases. The punctuality has been impacted severely by the candidate's health concerns. I appreciate that he was still able to complete the deliverables in sufficient quality despite the difficulties.

6. Self-reliance of the student

    [1] excellent self-reliance
  ▸ [2] **very good self-reliance**
    [3] average self-reliance
    [4] weaker, but still sufficient self-reliance
    [5] insufficient self-reliance

The candidate has clearly demonstrated the ability to work independently. He could have been more proactive in asking questions and discussing issues that he came across during the course of the work rather than spending excessive time and effort attempting to deal with all issues by himself.

The overall evaluation   77 /100 (C)

The candidate has completed a rather difficult bachelor's thesis assignment. While the punctuality and quality of the work have been impacted by reasons out of the candidate's control, leading to an extension of the deadline, he has clearly demonstrated the ability to independently find suitable literature to learn new concepts, navigate himself in a complex code base, and extend it with a well-designed implementation of the proposed method. The thesis presents a novel approach to co-evolution in symbolic regression and covers the objectives given in the assignment with certain flaws stated above, which justify the overall evaluation.

Instructions

Fulfillment of the assignment

Assess whether the submitted FT defines the objectives sufficiently and in line with the assignment; whether the objectives are formulated correctly and fulfilled sufficiently. In the comment, specify the points of the assignment that have not been met, assess the severity, impact, and, if appropriate, also the cause of the deficiencies. If the assignment differs substantially from the standards for the FT or if the student has developed the FT beyond the assignment, describe the way it got reflected on the quality of the assignment's fulfilment and the way it affected your final evaluation.

Main written part

Evaluate whether the extent of the FT is adequate to its content and scope: are all the parts of the FT contentful and necessary? Next, consider whether the submitted FT is actually correct – are there factual errors or inaccuracies?

Evaluate the logical structure of the FT, the thematic flow between chapters and whether the text is comprehensible to the reader. Assess whether the formal notations in the FT are used correctly. Assess the typographic and language aspects of the FT, follow the Dean's Directive No. 52/2021, Art. 3.

Evaluate whether the relevant sources are properly used, quoted and cited. Verify that all quotes are properly distinguished from the results achieved in the FT, thus, that the citation ethics has not been violated and that the citations are complete and in accordance with citation practices and standards. Finally, evaluate whether the software and other copyrighted works have been used in accordance with their license terms.

Non-written part, attachments

Depending on the nature of the FT, comment on the non-written part of the thesis. For example: SW work – the overall quality of the program. Is the technology used (from the development to deployment) suitable and adequate? HW – functional sample. Evaluate the technology and tools used. Research and experimental work – repeatability of the experiment.

Evaluation of results, publication outputs and awards

Depending on the nature of the thesis, estimate whether the thesis results could be deployed in practice; alternatively, evaluate whether the results of the FT extend the already published/known results or whether they bring in completely new findings.

Activity of the student

From your experience with the course of the work on the thesis and its outcome, review the student's activity while working on the thesis, his/her punctuality when meeting the deadlines and whether he/she consulted you as he/she went along and also, whether he/she was well prepared for these consultations.

Self-reliance of the student

From your experience with the course of the work on the thesis and its outcome, assess the student's ability to develop independent creative work.

The overall evaluation

Summarize which of the aspects of the FT affected your grading process the most. The overall grade does not need to be an arithmetic mean (or other value) calculated from the evaluation in the previous criteria. Generally, a well-fulfilled assignment is assessed by grade A.