FACULTY OF INFORMATION TECHNOLOGY CTU IN PRAGUE

Supervisor's statement of a final thesis

Supervisor:	doc. Dr. André Sopczak
Student:	Bc. Martin Rameš
Thesis title:	Search for tbH+(tautau) with Performance Optimisation for Signal and Background Separation Using Machine Learning with ATLAS Data
Branch / specialization:	Knowledge Engineering
Created on:	24 May 2023

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

All items of the thesis assignment have been fulfilled. The important development of adequate machine learning algorithms exceeded expectations. This work has been very skillfully completed. A major task has also been the use of the new analysis dataset which proved to be significantly different. A highlight of the thesis work was the independent study leading to the understanding of a discrepancy in the previous ntuple production for signal and background. These important works left little time in the end to address the aspect of systematic uncertainty evaluations, while the principle was addressed correctly.

2. Main written part

90 /100 (A)

The written part has been excellent and fulfilled already a high standard before comments on the thesis text were provided. Content and scope are fully compatible with the standards and the text well structured and comprehensible to the reader. Typographic and language aspects have a high standard. Citation ethics has been respected. Software and other copyrighted works have been used in accordance with their license terms, as applicable. Sources have been cited properly.

3. Non-written part, attachments

90 /100 (A)

The used software development and technology matches the high expectations. A particular challenge has been the software integration into the framework of the ATLAS

collaboration, and using the specific tools (root, trexfitter, and others). The testing of the software, cross-checking with previous results and understanding differences has been performed to a high level. Documentation of the code could have been extended to allow better usage in the future. Overall, the code development has been performed very well and adjusted to the needs.

4. Evaluation of results, publication outputs and awards 85 /100 (B)

The thesis results are correct and sufficient cross-checks have been performed. The comparison with previous results is convincing. As the systematic uncertainty evaluation has not been completed, the results are important and use fully the newly provided dataset, but the effect of systematic uncertainty remain to be completed later.

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 student had an excellent activity throughout the thesis project. He has been very attentive to comments and suggestions and also initiated new ideas for cross-checks and improvements. For consultations he has always been well prepared and. also was ready on time for presentations in the local working group and in the CERN working group.

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 student has shown excellent ability to develop independent creative work. His research and problem solving has been largely independent once the goal was clear. He pushed himself to match the deadlines and he has achieved the maximum possible in the allocated time scale.

The overall evaluation 90 /100 (A)

The results of the thesis advanced this particular research. The obtained sensitivity is competitive with previous results based on the statistical analysis. A high level of techniques has been applied and challenges with the complex ATLAS software structure and data storage has been mastered. The student is a very good presenter of the results and he made the new results and methods used clear to the expert team, he also presented his result, approved by the ATLAS collaboration, in the student session of the German Physical Society meeting in Dresden in March 2023.

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.