REVIEWER'S OPINION OF FINAL THESIS

I. IDENTIFICATION DATA

Thesis name:	**Bayesian Learning for Binary Neural Networks**
Author's name:	**Tejas Bhatnagar**
Type of thesis :	bachelor
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Cybernetics
Thesis reviewer:	doc. Boris Flach
Reviewer's department:	Department of Cybernetics

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment — extraordinarily challend

Evaluation of thesis difficulty of assignment.

The thesis assignment is in my view very challenging. It requires the student to familiarise with Bayesian learning in general and with quite advanced and complex methods like stochastic gradient estimators (ARM), networks with binary weights and activations etc.

Satisfaction of assignment — fulfilled with maior object

Assess that handed thesis meets assignment. Present points of assignment that fell short or were extended. Try to assess importance, impact or cause of each shortcoming.

The student fulfilled only parts of the first assignment. The second assignment remains unfulfilled.

Method of conception — correct

Assess that student has chosen correct approach or solution methods.

The chosen approach is adequate and novel.

Technical level — E - sufficient

Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.

The student showed the ability to familiarise with some of the needed concepts and, to a lesser extent, also to perform the essential theoretical derivations needed for applying them to the considered model classes. I can not judge about the students ability to implement the resulting algorithms because the thesis is not presenting experiments required in the assignments.

Formal and language level, scope of thesis — D - satisfacto

Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.

The formal notation used for deriving the necessary formulas for the considered algorithms is correct in parts only.

Selection of sources, citation correctness — C - good.

Present your opinion to student's activity when obtaining and using study materials for thesis creation. Characterize selection of sources. Assess that student used all relevant sources. Verify that all used elements are correctly distinguished from own results and thoughts. Assess that citation ethics has not been breached and that all bibliographic citations are complete and in accordance with citation convention and standards.

The student used all relevant sources and clearly distinguish between elements taken from literature and own thoughts.

Additional commentary and evaluation

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Present your opinion to achieved primary goals of thesis, e.g. level of theoretical results, level and functionality of technical or software conception, publication performance, experimental dexterity etc.
The theoretical goals are achieved to a satisfactory level. However, I am missing a motivation for some of the proposed models/methods. The experimental goals are not met and are missing in the thesis. I am providing additional comments to the student by annotations to his thesis

III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

Summarize thesis aspects that swayed your final evaluation. Please present apt questions which student should answer during defense.

The thesis of Tejas Bhatnagar proposes a novel approach for learning deep networks with binary weights and activations that is based on Bayesian inference. The proposed method is derived and explained to a satisfactory level with weaknesses in formal derivations and missing motivation of particular chosen models. The thesis does not cover the experimental part required in the task formulation. On the other hand, I believe that the task formulation was highly challenging for a bachelor thesis and tend to discount for this reason when recommending the following classification grade.

Questions for the defence:

1. *Explain the model introduced in Section 3.3 and its motivation*
2. *What is the run-time complexity of the ARM gradient estimator? Is it suitable for deep networks?*

I evaluate handed thesis with classification grade D - satisfacto

Date: **19.8.2022** Signature: