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Reviewer's opinion
on Ph.D. dissertation authored by

Izabela Krysińska

entitled:

BEYOND TRADITIONAL CURRICULUM LEARNING: SHAPING THE OPTIMIZATION PATH TO FIND BETTER MINIMA, FASTER

1. Problem and its impact

This PhD dissertation systematically explores curriculum learning, a promising methodology for training deep neural networks. While curriculum learning can improve training stability and convergence in complex tasks, its effectiveness strongly depends on careful curriculum design, task characteristics, and training dynamics.

This thesis addresses these aspects by investigating why and how a curriculum influences the dynamics of neural network training, and by introducing a formal framework for curriculum learning.

The validation process showed that a carefully designed curriculum learning can lead to more efficient training and better-performing deep learning models. Therefore, the outcomes of this thesis work can have an impact in different application domains.

2. Contribution

In my opinion, the contributions of the PhD dissertation by Izabela Krysińska are as follows:

- The investigation of why and how a curriculum influences the dynamics of neural network training.
- The definition of a formal framework for curriculum learning.
- The extensive experimental evaluation.

The main contribution of the PhD dissertation is the formal framework for curriculum learning. In this work, the two core modules of a curriculum has been defined, i.e., the scoring function and the pacing function. Moreover, two domains in which a curriculum can operate are defined, i.e., the data space and the task space.

As original contributions, this work introduces two scoring functions: a static, graph-based typicality measure for assessing sample representativeness, and a dynamic score based on the Variance of Gradients (VoG). In addition, a novel task-driven strategy, named Transitional Objective Learning (TOL), is proposed. Experimental results indicate that TOL is an effective approach for applying curriculum learning principles to structured prediction tasks.

Five datasets and three models were made available. I appreciated the decision to make these contributions publicly accessible to support future research activities and comparisons.

The content of the dissertation has been published as: 2 international journal papers and 2 international conference papers. For this reason, the quality of the contributions has already been verified and approved by an international research community. In my opinion, the **research contribution** of delivered in the dissertation by Izabela Krysińska is at **an international level**.

In my opinion, the reviewed dissertation by Izabela Krysińska addresses important, practical, and up-to-date research problems in the area of deep neural networks. The dissertation contributes practical solutions to these problems. The solutions are suitable for a PhD and the **PhD should be accepted for an oral defense**.

I outline here a couple of suggestions for possible integrations.

If possible, I would suggest commenting on the potential computational cost introduced by the use of curriculum learning within the proposed framework. In particular, it would be of interest discussing which factors may influence this cost, such as the data type and application context, as well as the dataset size (e.g., number of features and/or dataset cardinality), or other possible factors.

If possible, it would also be of interest to outline which application domains could benefit most from the proposed approach, as well as those in which the approach may be difficult to apply or yield limited benefits.

The above observations are potential improvements. They do not downgrade my **positive** evaluation of the dissertation.

3. Correctness

The thesis manuscript is very well structured and well written. The proposed solutions were well described and well motivated.

The experimental validation was well organized, and several types of datasets were considered for the experiments.

Minor point: To improve the readability of the presented results, I suggest highlighting the best-performing results in bold in tables that report performance comparisons.

4. Knowledge of the candidate

To validate and demonstrate the utility of the proposed framework a comprehensive overview of past research has been conducted, also considering recent references.

Each chapter presenting a contribution of the PhD dissertation also includes a related work section summarizing the relevant state-of-the-art, such as related to “typicality scoring” in Chapter 3, “variance of gradients scoring” in Chapter 4, “batch orchestration” in Chapter 5, and “transitional object learning” in Chapter 6.

A substantial analysis of the state-of-the-art is conducted in Chapter 2, which establishes the theoretical foundation of the thesis. It provides an in-depth review of the field and a critical examination of prior work.

This state-of-the-art study demonstrates a very good knowledge of Izabela Krysińska in the discipline of Information and Communication Technology and in particular a strong expertise of in curriculum learning area.

5. Conclusion

Taking into account what I have presented above and the requirements imposed by Article 187 of the A*ct of 20 July 2018 - The Law on Higher Education and Science* (with amendments)[1], my evaluation of the dissertation according to the three basic criteria is the following:

A. Does the dissertation present an original solution to a scientific problem? (the selected option is marked with **X**)

[X]	[ ]	[ ]	[ ]	[ ]
Definitely YES	*Rather yes*	*Hard to say*	*Rather no*	*Definitely NO*

B. After reading the dissertation, would you agree that the candidate has general theoretical knowledge and understanding of the discipline of **Information and Communication Technology**?

[X]	[ ]	[ ]	[ ]	[ ]
Definitely YES	*Rather yes*	*Hard to say*	*Rather no*	*Definitely NO*

C. Does the dissertation support the claim that the candidate is able to conduct scientific work?

[X]	[ ]	[ ]	[ ]	[ ]
Definitely YES	*Rather yes*	*Hard to say*	*Rather no*	*Definitely NO*

Signature

[1] http://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20190000276