



Bratislava, June 21, 2025

Review of a Doctoral Thesis at FIT CTU Prague

Doctoral student: Vojtěch Vančura

Title of the thesis: From Collaborative to Content-Based: Scaling Autoencoders to Train
Transformers in Recommender Systems

Supervisor: Assoc. Prof. Pavel Kordík

Reviewer: Prof. Mária Bieliková

The results of the work and novelty:

The submitted dissertation addresses the highly relevant and actively researched domain of recommender systems. The author aims to develop scalable and efficient recommender models to improve recommendations in cold-start and zero-shot scenarios where traditional methods struggle due to a lack of historical user data. The work also demonstrates the benefits of using Large Language Models to generate item descriptions for enhanced cross-domain recommendations. It ultimately seeks to create more efficient recommender systems for real-world industrial applications, which is a very active topic today.

The central contribution of the dissertation is the development and evaluation of innovative algorithms, particularly ELSA, and beformer models. The beformer model leverages user-item interaction data to enhance item embeddings derived from attributes such as text descriptions or images, ensuring that item similarity also reflects interaction closeness. ELSA and Sparse ELSA provide efficient embedding learning solutions by effectively addressing data sparsity issues, a common and significant challenge in recommender systems. These methods notably scale much better than the established sparse shallow autoencoder EASE proposed by Harald Steck. Furthermore, an interesting comparative discussion would involve analyzing the performance and scalability differences between Sparse ELSA, EASE, and SANSA, another recently published scalable sparse autoencoder.

The author provides rigorous experimental validation of these contributions, utilizing both synthetic datasets and multiple real-world datasets. The experiments demonstrate notable improvements in recommendation accuracy, coverage, and user engagement compared to existing baseline methodologies.



Formal aspects of the thesis:

The dissertation is logically structured and follows a clear format. It begins with an Introduction clearly outlining the research questions, objectives, and explicit contributions. The subsequent chapter provides a background and overview based on a comprehensive literature review of existing recommender system methodologies. It includes descriptions of various concepts related to the broad topic of recommender systems, resulting in a general and rather superficial discussion of the subject.

The two central chapters systematically describe the conceptual development and evaluation of the proposed models (ELSA, Sparse ELSA, and beformer). The text and structure are mostly taken from the papers first authored by the doctoral student, which results in a concise description of the related work, architecture of models, training procedures, and evaluation. However, it would be beneficial to have a more detailed comparative discussion highlighting specific limitations of existing approaches.

While the results convincingly demonstrate the advantages of the proposed methods, further exploration of potential failure modes or limitations of the introduced algorithms would strengthen the critical analysis of the dissertation.

Overall, the dissertation is clearly written, well-organized, and maintains good readability standards. Figures and tables effectively support and enhance the text. Referencing “paper” in chapters 3 and 4 is a bit misleading, but still acceptable.

Quality of publications:

The work presented in this thesis was accepted and published in six papers on the conferences relevant to the topic (Recommender Systems – CORE A, User Modelling and Adaptation – CORE B and Artificial Neural Networks – CORE C), five of them authored by the doctoral student as the first author. While this confirms the significance of the work, pursuing more ambitious publications in journals or A* ranked venues would substantially enhance the dissertation's impact.

More comments:

- scenarios or data characteristics under which ELSA or beformer might underperform compared to simpler or alternative recommendation algorithms could be discussed in more detail
- the author presents nine contributions (chapter 5.2) without further explanation, it would be useful if the contributions were supported by a justifying text and presented at a higher level of abstraction, together with a discussion on the potential impact on the field
- the future work is described in six bullet points; it would be desirable if the author included a discussion of the future work.

Conclusions:

The dissertation provides substantial contributions to the field of recommender systems, notably:

- The introduction of ELSA, a scalable linear shallow autoencoder addressing the computational limitations of existing models for collaborative filtering that enhances the existing autoencoder EASE, and a comprehensive evaluation of the proposed model compared to recent state-of-the-art models both online and offline.
- Proposal of beeFormer, a framework leveraging transformer architectures for effective training directly with user interaction data, bringing the gap between content-based and collaborative filtering.

In summary, Vojtěch Vančura proved substantial knowledge, methodological precision and eligibility to creative research work. Results achieved present a contribution in the research field of recommender systems in accordance with the evaluation above. Without doubt Vojtěch provided contributions which are worthy of a PhD degree. I can state that Vojtěch Vančura in his doctoral dissertation has demonstrated the ability to work independently and creatively in the specified field.

The dissertation meets the standard requirements imposed on a doctoral dissertation in the specified field. It presents a strong piece of research work. I recommend accepting the dissertation as fully satisfactory to the degree of Doctor of Philosophy.



Prof. Maria Bielikova, PhD.

