Commentary on *Deep Learning Based Recommender System: A Survey and New Perspectives*

Introduction

This systematic review, by authors Shuai Zhang and Lina Yao from the University of South Wales and Aixin Sun and Yi Tay from the Nanyang Technological University, introduces the reader to the state of the art (as of the beginning of 2019) in the use of deep learning in recommender systems.

The authors are very thorough, classifying and summarising the immense amount of studies according to their content and presenting them with visual aid.

This whole document pertains to up to and including section 3.4 of the article at hand. So when I write "the paper", "the study", "the article", etc. I refer only to such parts of it.

Commentary

I think that, overall, the study did a remarkable job at communicating the ideas and techniques being used at the time (which is relatively recent), mainly because they introduce the reader briefly to recommender systems and deep learning – and to the reasons to combine them – before they begin writing about every model.

Also, they seem to be keen on categorising topics and modelling techniques. This inclination to organise can be evidenced in the following image, with which the authors differentiate deep learning models for recommender systems.

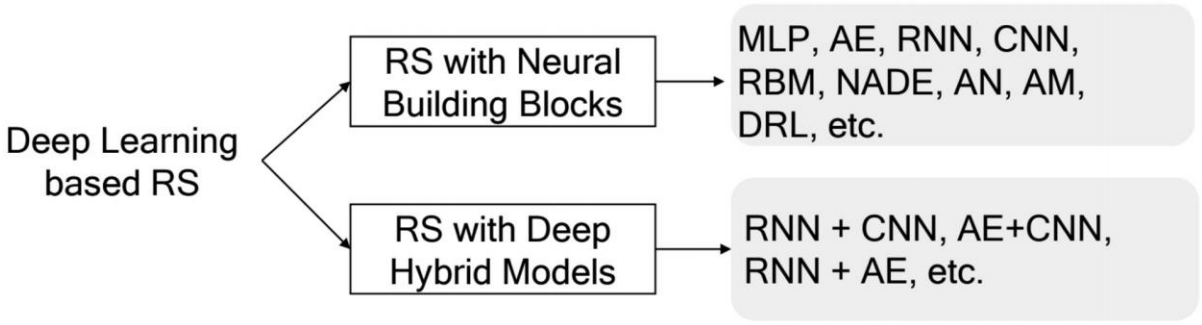

Fig. 1. Categories of deep neural network-based recommendation models.

I do not believe that this categorisation, in particular, is necessary due to the difficulty of differentiating a model between hybrid and non-hybrid. For example, many of the purportedly non-hybrid models presented utilise deep learning plus some more traditional recommendation form, such as matrix factorisation. Would those models be truly non-hybrid?

Besides the small detail of, in my opinion, the above not quite useful model categorisation, almost everything was clear. The only last conveyance related observation would be that, sometimes, the

objective or *modus operandi* of models are not too clear. For instance, in a *collaborative Denoising Auto-Encoder (CDAE)*, a "user node" and a matrix V_u of weights related to it is mentioned. To me, it appears that the node and the weight matrix are the same, but this does not seem right. I would need to refer to the original article about CDAE to verify that, which is not necessarily a bad thing. After all, systematics reviews are reference material.

Final Thoughts

One curious aspect of the presented studies is that they usually rely on or, at least, have some use for non-deep learning approaches. In particular, I noticed matrix factorisation and factorisation machines are extremely popular still. This is sensible, especially when the fact that factorisation is akin to training a neural network. However, I am not sure if traditional methods *need* to remain in the literature for much longer. At least as a part of the main contribution (as opposed to as baselines). Deep learning is powerful enough by itself to learn complex recommendation tasks, and it has become effortless to use given the availability of tools like PyTorch or Keras, which seem to lack a comparable counterpart in the recommendation system's domain. So, I think we could be a little less conservative and save time and effort if we put more of our trust in deep learning alone for recommender systems.