Ph.D. in Information Technology:
Dr. QUADRANA
Thesis Defense

Villa Erba – Sala Lario, Cernobbio (CO)
August 29th, 2017
04.30 pm

Ph.D. presentation and discussion:

Dr. Massimo QUADRANA – XXIX Cycle
"Algorithms for Sequence-Aware Recommender Systems"
Advisor: Prof. **Paolo Cremonesi**

Abstract:

Academic research in the field of Recommender Systems in the recent past was strongly fueled by the increasing availability of large datasets containing user-item rating matrices. Many of these works were therefore based on a problem abstraction where only one single user-item interaction is considered in the recommendation process. The recommendation problem is therefore framed as matrix-completion, in which the missing entries in the user-interaction matrix must be predicted.
In many application domains, however, multiple user-item interactions of different types can be recorded over time. Most algorithms that are optimized for this particular problem setting cannot make use of the rich information that is hidden in the sequentially-ordered user interaction logs which are often available in most practical applications. In addition, there are application domains, in which the items must be recommended in a certain order. Such situations are typically not covered as well in research setups that rely on a user-item rating matrix.
To address this problem, in the recent years researchers have developed a new breed of algorithms named sequence-aware recommender systems (SARS). Such algorithms can handle the information in user interaction logs by design without resorting on abstractions such as the user-item matrix.
This thesis focuses on the study of novel algorithms for sequence-aware recommender systems and their applications. We first provide a characterization of the problem, by highlight the relations and differences with respect to other related recommendation problems.
We then focus on the problems of session-based and session-aware recommendation. These problems have gained attention recently, given their proximity with many real-world recommendation scenarios.
We first validate the usefulness of personalized sequence-aware recommendations in session-based scenarios through a user study run in the hotel booking domain.
We then present novel sequence-aware algorithms for session-based and session-aware recommendation. In such a setting, we are given the sequence of the most recent actions of a user and the problem is to find items that are relevant in the context of the session and, when historical information on the user is available, match the user's general taste.
In particular, we investigate on models based on Recurrent Neural Networks (RNNs), the neural network configuration of choice for processing sequentially-ordered data. We show the effectiveness of sequence-aware recommenders based on RNNs in several real-life

scenarios, namely session-based recommendation with rich product descriptors, personalized session-based recommendation for returning users, modeling of musical taste evolution, and automated playlist generation.
We empirically evaluate the proposed models on large datasets from several domains, namely video, classified advertisement, hotel, job and music recommendation. Our results show that our sequence-aware models are indeed effective in a huge variety of recommendation scenarios.

PhD Committee:
Prof. Paolo Cremonesi, DEIB
Prof. Pasquale Lops, Università di Bari
Prof. Hossein Vahabi, Pandora, USA