Lecture 18

- Hybrid Recommendation Techniques

IT492: Recommendation Systems (AY 2023/24) — Dr. Arpit Rana

Recommendation Techniques

Technique	Background	Input	Process
Collaborative	Ratings from **U** of items in **I**.	Ratings from **u** of items in **I**.	Identify users in **U** similar to **u**, and extrapolate from their ratings of **i**.
Content-based	Features of items in **I**	**u**'s ratings of items in **I**	Generate a classifier that fits **u**'s rating behavior and use it on **i**.
Demographic	Demographic information about **U** and their ratings of items in **I**.	Demographic information about **u**.	Identify users that are demographically similar to **u**, and extrapolate from their ratings of **i**.
Utility-based	Features of items in **I**.	A utility function over items in **I** that describes **u**'s preferences.	Apply the function to the items and determine **i**'s rank.
Knowledge-based	Features of items in **I**. Knowledge of how these items meet a user's needs.	A description of **u**'s needs or interests.	Infer a match between **i** and **u**'s need.

Trade-offs between Recommendation Techniques

Technique	Pluses	Minuses
Collaborative filtering (CF)	A. Can identify cross-genre niches. B. Domain knowledge not needed. C. Adaptive: quality improves over time. D. Implicit feedback sufficient	I. New user ramp-up problem J. New item ramp-up problem K. 'Gray sheep' problem L. Quality dependent on large historical data set. M. Stability vs. plasticity problem
Content-based (CN)	B, C, D	I, L, M
Demographic (DM)	A, B, C	I, K, L, M N. Must gather demographic information
Utility-based (UT)	E. No ramp-up required F. Sensitive to changes of preference G. Can include non-product features	O. User must input utility function P. Suggestion ability static (does not learn)
Knowledge-based (KB)	E, F, G H. Can map from user needs to products	P Q. Knowledge engineering required.

Comparison of Collaborative and Content-based Methods

Criteria	Collaborative	Content-based
Cold-start User	Yes	Yes
Cold-start Item	Yes	No
Limited Content Analysis	No	Yes
Over-specialization	No	Yes
Sparsity	Yes	No
Popularity Bias	Yes	No
Interpretability	Less	More

Definition

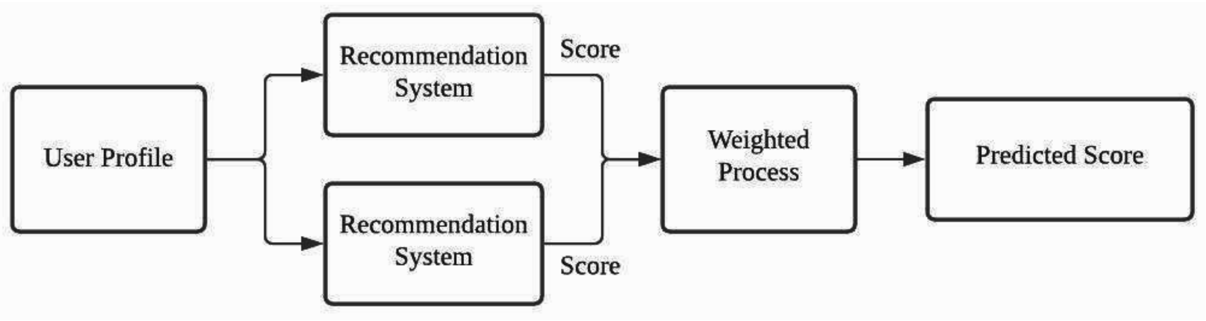
Hybrid recommender systems -

- combine two or more recommendation strategies
- to benefit from their complementary advantages

Weighted Hybrid Recommender

A weighted hybrid recommender is one in which -

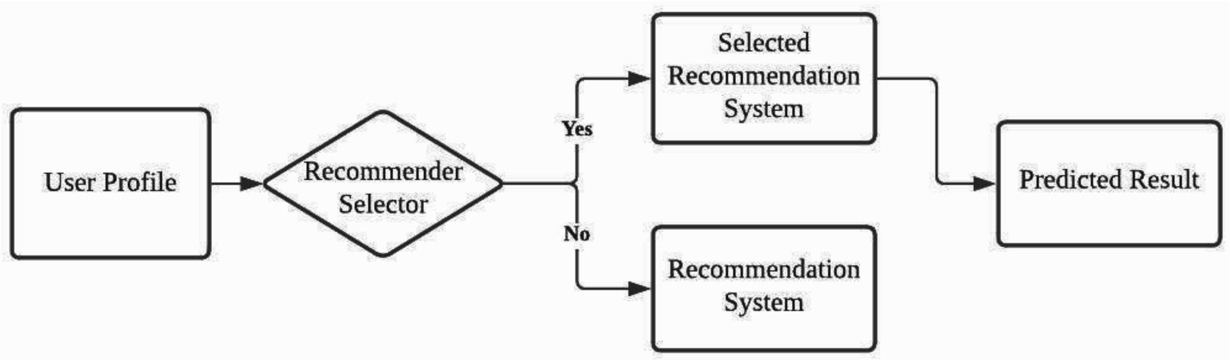
- the score of a recommended item is computed from the results of all of the available recommendation techniques present in the system
- e.g., the simplest combined hybrid would be a linear combination of recommendation scores
- The implicit assumption is that the relative value of the different techniques is more or less uniform across the space of possible items



Switching Hybrid Recommender

A switching hybrid builds in item-level sensitivity to the hybridization strategy:

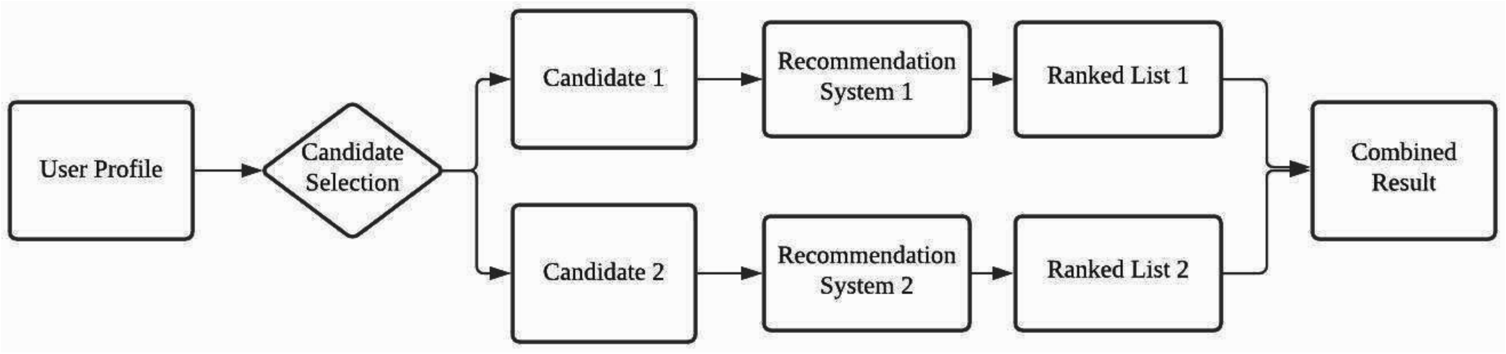
- the system uses some criterion to switch between recommendation techniques
- the switching criteria must be determined, and this introduces another level of parameterization.
- the benefit is that the system can be sensitive to the strengths and weaknesses of its constituent recommenders



Mixed Hybrid Recommender

Mixed hybrids are used where it is practical to make large number of recommendations simultaneously,

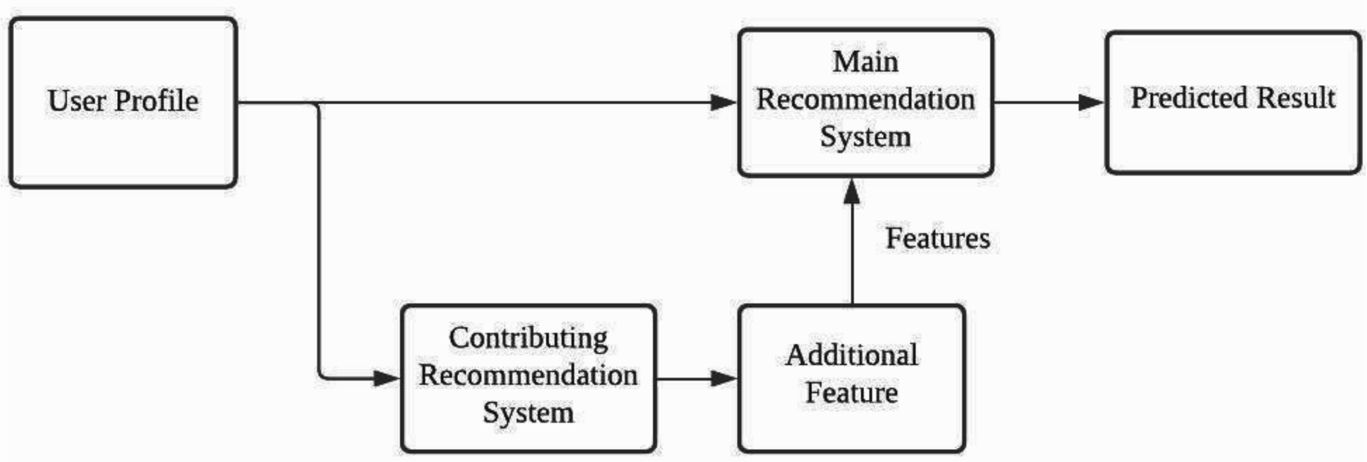
- recommendations from more than one technique are presented together
- to rank the items or to select a single best recommendation, some kind of combination technique must be employed



Feature Combination

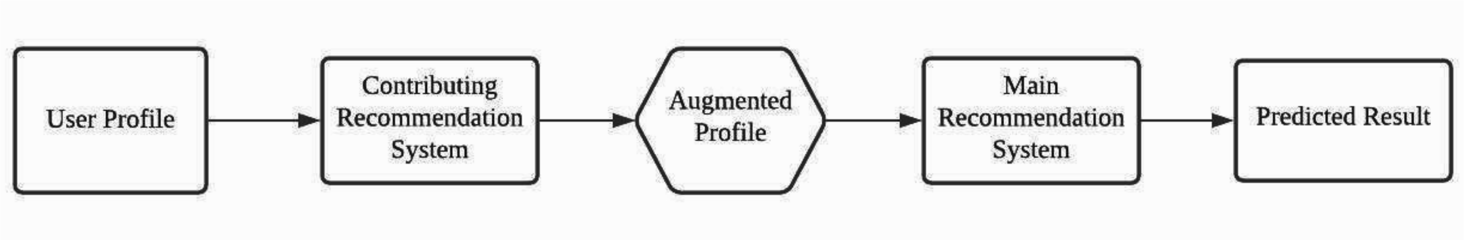
Another way to achieve the content/collaborative merger is -

- to treat collaborative information as simply additional feature data associated with each example, and
- use content-based techniques over this augmented data set



Feature Augmentation

- A contributing recommendation model is employed to generate a rating or classification of the user/item profile,
- which is further used in the main recommendation system to produce the final predicted result



Meta-level

- It is similar to the feature augmentation, such that the contributing model is providing augmented dataset to the main recommendation model

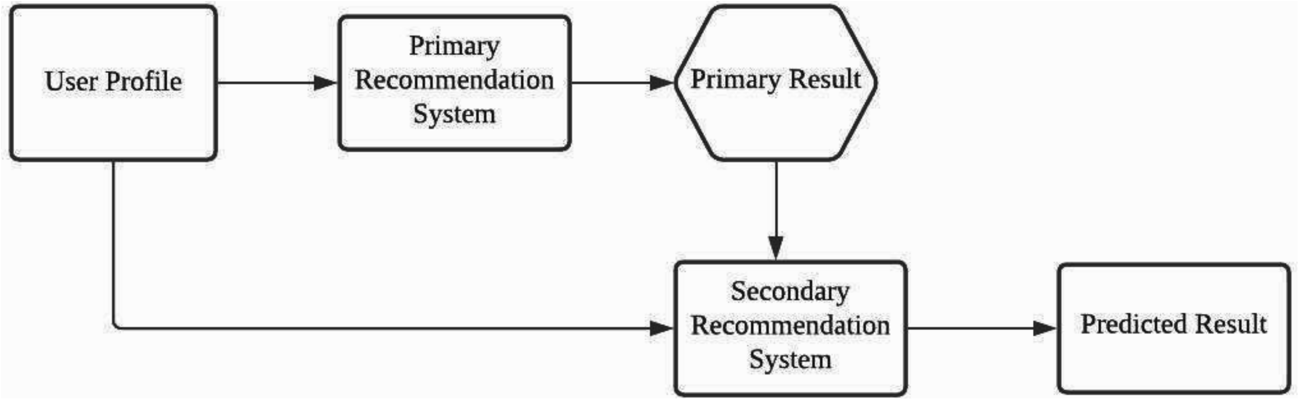
- Different from the feature augmentation hybrid,

  - meta-level replaces the original dataset with a learned model from the contributing model as the input to the main recommendation model

Cascade Hybrid Recommender

In this technique,

- one recommendation technique is employed first to produce a coarse ranking of candidates and,
- a second technique refines the recommendation from among the candidate set.



Next Lecture

- Re-ranking Techniques for Recommendations