# Recommendation System Algorithms

To implement an **item based collaborative filtering,**KNN is a perfect go-to model and also a very good baseline for recommender system development. **KNN** is a **non-parametric, lazy**learning method (Liao, 2018). It uses a database in which the data points are separated into several clusters to make inference for new samples. The **advantages** for KNN include that it is seamless to add new data making it more of a model-based approach, easy to implement and fast to compute as compared to regression approaches. **Disadvantages** for KNN include high dimensionality, since it can’t process multi-dimension problems, it also requires features scaling and is sensitive to outliers and noisy data.

**Matrix factorization** is a class of [collaborative filtering](https://en.wikipedia.org/wiki/Collaborative_filtering) algorithms such as SVD and PCA used in [recommender systems](https://en.wikipedia.org/wiki/Recommender_system). Matrix factorization algorithms work by decomposing the user-item interaction [matrix](https://en.wikipedia.org/wiki/Matrix_(mathematics)) into the product of two lower dimensionality rectangular matrices. This family of methods became widely known during the [Netflix prize](https://en.wikipedia.org/wiki/Netflix_prize) challenge due to its effectiveness (Wikipedia, 2021). Main **advantages** of this approach allow the method to be adjusted multiple dimensions with the help of dimension reduction and regularization. It has many forms available for implementation which are affordable and easy to integrate. **Disadvantages** can be described as Matrix factorization often tends to recommend popular items to everyone which does not always reflect the specific user interests mostly when Dot products are used (Roy, 2020). The matrix factorization also had the cold start problem due to the fact that it had no feature vector or embedding for the new items also it would require a complete retrain of the model to adjust for incoming data.

**Neural networks** have recently grown to popularity with the recent advancements in technology and computations. NNs work on chained perceptron with different approaches for activation functions for making decisive decisions. Popular deep learning approaches for recommendation systems include Neural Collaborative filtering NCF and Long Short-Term Memory LSTM. **Advantages** forNeural networks specifically LSTM (Long Shot Term Memory) are that itcan accurately detect the changes in trends over a period of time. They also have a good fault tolerance. **Disadvantages** include them needing vast amount of data for making decisions, they require time and expertise to be implemented fittingly for the situation and as a whole NNs are a black box the since the internal workings of the algorithm remains hidden from humans’ reach.

**Decision trees** partition data into classes with a series of hierarchical decisions. Each **internal node** of the tree representation denotes an attribute and each **leaf node** denotes a class label. A decision tree algorithm can be used to solve both regression and classification problems (Dhiraj, 2019). **Advantages** of this methodology include easy implementation, no scaling of data and as Compared to other algorithms decision trees requires less effort for data preparation during pre-processing. **Disadvantages** for this DTs can cause large changes in structure with small change in data. For a Decision tree sometimes, calculation can go far more complex compared to other algorithms (Dhiraj, 2019). Decision tree often involves higher time to train the model. Decision tree training is relatively expensive as the complexity and time has taken are more

# References

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