**Intelligent Promotional Planning**

When retailers plan promotions they lack information about the total effect of their decisions.

It is a known effect of recommender models that the recommendation of one product can have both positive and negative effect on non-recommended products. Promotions in retail have similar effects. The promotion of a product can cause an increase in sales of positively correlated products whereas negatively correlated (cannibalization) products can experience decrease in sales.

In this project we would like to first examine wheather the cannibalized products can be identified by learning their features, using a content-based recommender. Secondly we would like to see if a machine learning model using product features, as well as the correlation from the sales history, can give a better idea of the total effect of a promotion than a basic statistical model that only uses information about correlation from sales history.

*Hypothesis 1:*

Item features can be used to determine if an item will be cannibalized when another item is promoted.

*Hypothesis 2:*

A machine learning system can give better results than a statistical model for evaluating the expected profit/loss of an item promotion (using correlation, item features).

*Outcome of the project:*

A system that evaluates the outcome of an item promotion, taking into account cannibalization and correlation, using features, sale history and forecasts. The system outcome is the expected value of the promotion ($)

*Models that will be examined:*

- Baseline model: statistical model based on sale history correlation.

- Neural networks

- Clustering (features)

- …

*Future work*

Iterate over all items to find the best items for promotion. This way the system would be able to give the retailer a list of the products that are predicted to yield the highest total profit, when promoted.

1. Market Basket Analysis

Find highly correlated items, i.e. items that are frequently sold together, using e.g. association rule learning.

Company motive: When planning a promotion of item X, they can see the estimated % of increased sale of its correlated items.

2. Content-Based Recommender

Train a content-based recommender system to find items similar to item X, based on the item‘s profile which contains both structured and unstructured data.

Company motive: By showing the cannibalization items (items negatively affected by the promotion of item X), the retailer can make better informed decisions when planning promotions, knowing more about how it will affect the total profit.

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When answering hypothesis 1, the outcome would be a set of features that indicate the cannibalization items.

The next part of the thesis would be to make a ML model that uses both correlation and item features and prove that the ML model can be better than a simple statistical model that uses correlation. I.e. that item features can be used to improve forecasts on promotional planning.

* The cannibalization items are identified by taking a look at the forecast and the real sale history during the promotion. The cannibalization items are the ones that drop in sales during this period.