DEMAND FORECASTING AT M&S

Matt White

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M&S
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First steps in the application of ML techniques to deliver demand forecasting and product fulfilment improvements at M&S
Summary

- New forecasting methods including machine learning offer the prospect of improved forecast accuracy and higher product availability.

- They need to be effectively incorporated into the demand forecasting processes of the organization.

- The session will explain the approach taken in M&S Clothing and Home to date including the tools and skills used.

- It will also reflect on learnings so far and a vision of a future incorporating advanced analytics into everyday operational processes.
DEMAND FORECASTING AT M&S

- Demand and Fulfilment teams in each Business unit
- Centralised Supply Chain development supporting
- Planning c20m SKUs
- Planned in JDA Demand and Fulfilment
- 2 main algorithms used, JDA Lewandowski and AVS Graves at store level
- Lost sales calculated in JDA
- New product forecasting based on commercial estimate + shape
### Plan Analysis: Plan Analysis - LOCTYPE

| Scenario | 20/06/19 Sat | 21/06/19 Sun | 22/06/19 Mon | 25/06/19 Wed | 26/06/19 Thu | 27/06/19 Fri | 30/06/19 Fri | 01/07/19 Sat | 02/07/19 Sun | 03/07/19 Mon | 04/07/19 Tue | 05/07/19 Wed | 08/07/19 Wed | 09/07/19 Thu | 10/07/19 Thu | 13/07/19 Thu | 14/07/19 Thu | 15/07/19 Thu |
|----------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| SKU_DAIL | 0            | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| 90       | 0            | 0           | 200         | 528         | 1,524       | 1,802       | 0           | 9,012       | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| MSL_5S  | 0            | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| OIL_PRES | 0            | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| SCHED/PRTNTRANS | 0.616 | 0 | 0 | 0 | 0 | 0 | 0 | 8.620 | 0 | 0 | 0 | 0 | 0 | 0 | 908 | 0 | 0 | 0 |
| RECARR/REV/TTNWT | 0.616 | 0.616 | 0.616 | 15,600 | 15,600 | 15,600 | 15,600 | 15,600 | 15,600 | 15,600 | 15,600 | 15,600 | 15,600 | 15,600 | 15,600 | 15,600 | 15,600 | 15,600 | 15,600 |
| PEC RunOff | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PLANS/FTP_TARGET | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

![Graph](image-url)
The JDA Moonshot

Blue Yonder acquired to enhance traditional forecasting capability

Digital Supply Chain Maturity

- **Visibility**
  - Managing constraints
  - Multi-source integration

- **Predictive Analytics**
  - Using big data & predictive Algorithms:
    - Predict issues

- **Prescriptive Supply Chain**
  - Powered by Machine learning:
    - Prescribing course of action to resolve problems

- **Self-Learning Supply Chain**
  - Enabled by deep learning:
    - Anticipate
    - Sense
    - Act
    - Analyze
    - Learn
    - Adjust strategies
ADVANCING TECHNIQUES COMBINED WITH TRADITIONAL METHODS

All M&S Clothing & Home lines have a **seasonal profile**

A seasonal profile is essentially the shape of sales across a selling period, showing peaks and troughs.

They are essential for 2 reasons:

1. **Direct the shape of forecast**
2. Enable **effective cleansing of history** with which to make a forecast
SEASONAL PROFILING

Seasonal Profiling Creation Process

Data
- Extract data
- Data cleansing

Clustering
- Run clustering
- Number of clusters
- Calculate and name profiles in JDA

Classification
- Run Classification
- Suggest profile(s) to live products
- Select profile for live products

Upload profiles into JDA
Upload attachment into JDA
**SEASONAL PROFILING**

1. For each cluster, a shape is created (average of cluster components)

2. **Smooth**: we want to remove non-seasonal spikes (random, promotions) and *keep the seasonal spikes* (Easter, Father’s day, Christmas etc.)
SEASONAL PROFILING

- A dashboard was created to assess the accuracy and suitability of the shapes
- Product sales are compared to their profiles

In case of bad accuracy:
1. Attach another existing profile
2. Or refresh the profiles: this will not update profiles individually but all the profiles (because of the clustering)
DEVELOPMENT WITH JDA

*Leveraging shared analytics capability and technology*

- In 2018, M&S & JDA started a project to understand product substitution
- Could we predict what customers would switch to if their first choice product was out of stock on line?
Can Machine Learning be used to identify alternative products that our customers want to buy?

Could an understanding of demand transference improve customer availability?
Demand transfer exists - The POC was able to forecast the percentage gain in sales of other items within the group when an item was out of stock.

1. 1700U/BLACK goes out of stock
2. 1700U/GREY increases by 2%
NEXT STEPS FOR COGNITIVE DEMAND

- Widen the model – look at the potential for Demand Substitution in other departments

- Evaluate the application of Demand Substitution – demand dashboard alerts vs. auto transfer

- Weather variance – investigate regional variations in weather to respond to customer requirements
ANALYTICS & ORGANISATIONAL CONSIDERATIONS

- Hiring the right team – rights skills and ability to work in an agile environment
- Onboarding process
- Ability to communicate analysis and help guide the correct questions
- Where should analysts sit? – central group or with commercial teams?
- Need better ways to assess performance, and grade analysts
- Progression based on technical competence
- The right training – on what tools?
- Retaining analysts while the organisation moves to being data driven
- Starting to collect the right data that will be useful in the future
- Cultural challenges - pull for “Allocation” and control
- Should we use the forecast to measure availability?