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Short-term internship at consulting company B12

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B12 is a consulting company based in Louvain-la-Neuve. Founded in 2012 by 3 PhD's from UCLouvain. They employ around 20 people and their expertise is mainly focused on

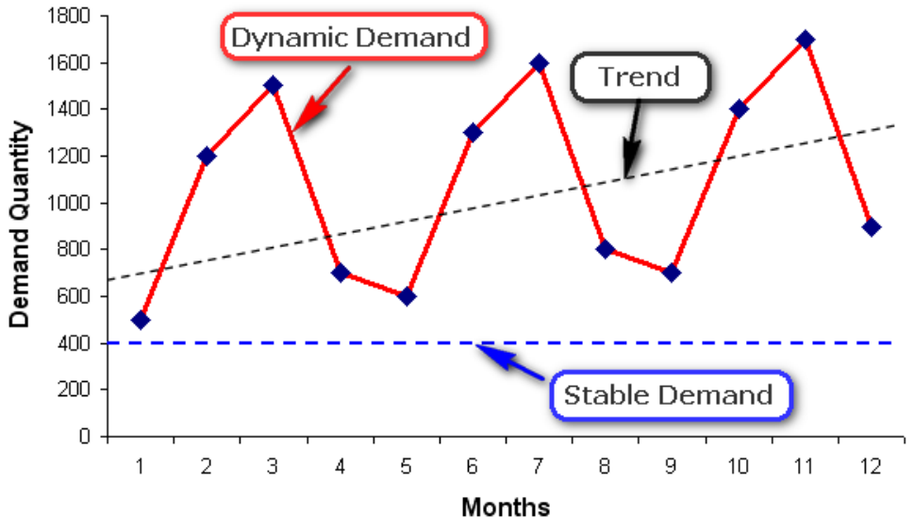
- **Consulting**
- **Software development**
- **Advanced data analytics**

Strong emphasis on scientific method, most of the people have a scientific degree and a good chunk a PhD in physics.

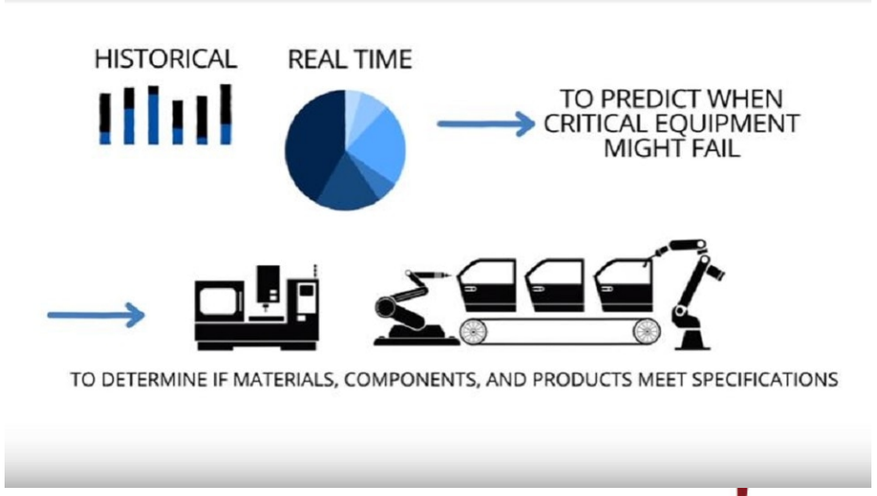
I started working at B12 full-time at the beginning of November 2018 and will end at the end of January 2019.

Assigned to the data science team, I have worked on 2 projects involving demand forecasting and predictive maintenance.

Demand forecasting is a field which tries to understand and predict customer demand to optimise supply decisions.



Predictive maintenance techniques have the objective of predicting breakdowns in order to perform maintenance in advance and avoid costly reparations.



Scheme of the workflow

- ❖ **Historical data with sales over the last 15 years.**
- ❖ **Data exploration and data cleaning.**
- ❖ **Try different methods to find patterns**
  - **Polynomial regression**
  - **VAR** $\vec{y}_t = A_1\vec{y}_{t-1} + A_2\vec{y}_{t-2} + ... + A_n\vec{y}_{t-n} + C$
  - **Forecasting tool Facebook Prophet**
- ❖ **Data enrichment**
  - **Add relevant data to improve predictions (macro, micro-economic, etc)**
  - **Devise a regression method making use of an enriched data set**

Scheme of the workflow:

- **Historical data over the last year of breakdowns of various components.**
- **Historical data of the system status over the same period.**
- **Data on external agents that are allegedly playing a role.**
- **Data cleaning and preprocessing.**
- **Feature selection and regression** $y(t) = c_1 x(t) + c_2 z(t) + \ldots + c_n$

Project still on-going, possible application of more powerful methods (deep learning) and addition of relevant data on the status of the system.

- Deal with actual and imperfect data
- Work in a team
  - Share code
  - Discuss over ideas
- Coding, coding and coding
  - Jupyter notebooks, pandas, matplotlib and numpy
  - Machine learning
- Deal with tight deadlines
- Deal with clients, understand their needs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- **Machine learning and coding manners**
  - **Write better code**
  - **The importance of documenting and commenting**
  - **ML methods for Particle Physics**
- **Broadened my expertise, getting out of my comfort zone**
- **There is other interesting stuff going on outside of physics**
- **Being a physicist is kind of cool**