Mind over Data:
Retail Challenge

Group Y:

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Context

Mind over Data trusted us to help them on our first real world problem and challenged us to do produce solutions for the following challenges:

- Data/Feature Engineering
- Quarterly analysis of each Point-of-Sale characteristics
- Point-of-Sales Clustering
- Units Product forecast

Our Data

Our original data was a csv file with 27GB containing:

- 9 columns
- 21 Families of Products
- 178 Categories of Products
- 1 535 Brands Products
- 8 660 SKUs
- 410 Point-of-Sales
- Sales data from almost 3 years

Data Preprocessing

Steps performed:

- Regular expression (*Regex*) preprocessing
- Feature *downcasting*
- Data trimming
- Data aggregation
- Feature Engineering

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Quarterly analysis

Solution implemented using:

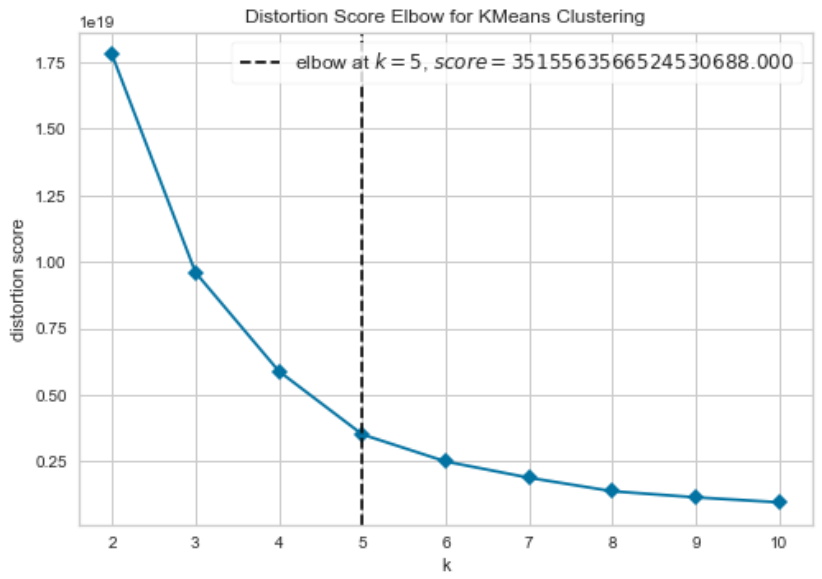
Clustering

K-Prototypes:

- POS_ID as guide (*groupby*)
- Metric Features: Total_Value, Total_Units
- Categorical Features: ProductFamily_ID, ProductName_ID, ProductBrand_ID

Silhouette	Calinski-Harabasz	Davies-Bouldin
0.54	1356.65	0.50

POS_ID	Total_Value	Total_Units	ProductFamily_ID	ProductBrand_ID	ProductName_ID
1	978670349.77	609151	21	1472	1228
2	635534919.91	390484	12	133	253
3	1048120296.56	602120	21	1472	253
4	1261300284.63	797480	21	1472	253
5	668177864.75	423022	21	1472	253
6	628293081.42	391811	21	133	253
7	438050582.83	292544	21	133	253
8	1196780448.41	776041	21	1472	253
9	752055977.18	456590	21	1472	1228
10	425764712.91	261983	21	133	253



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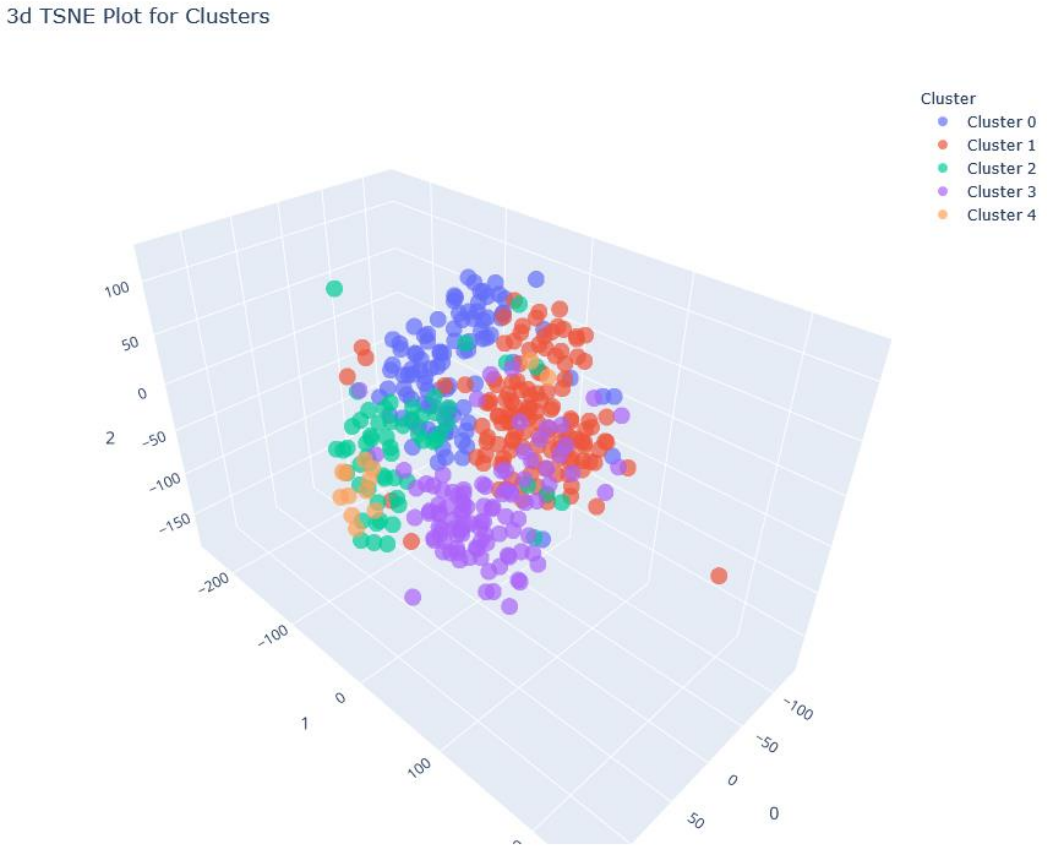
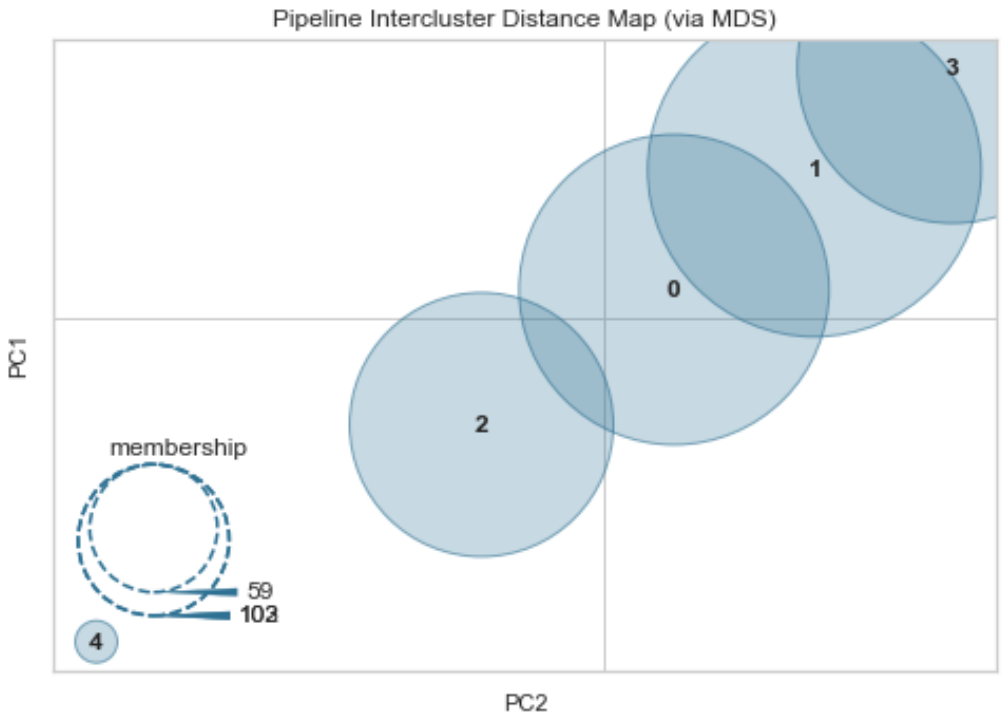
Clustering



Clustering



Cluster 3: lowest value, less purchases

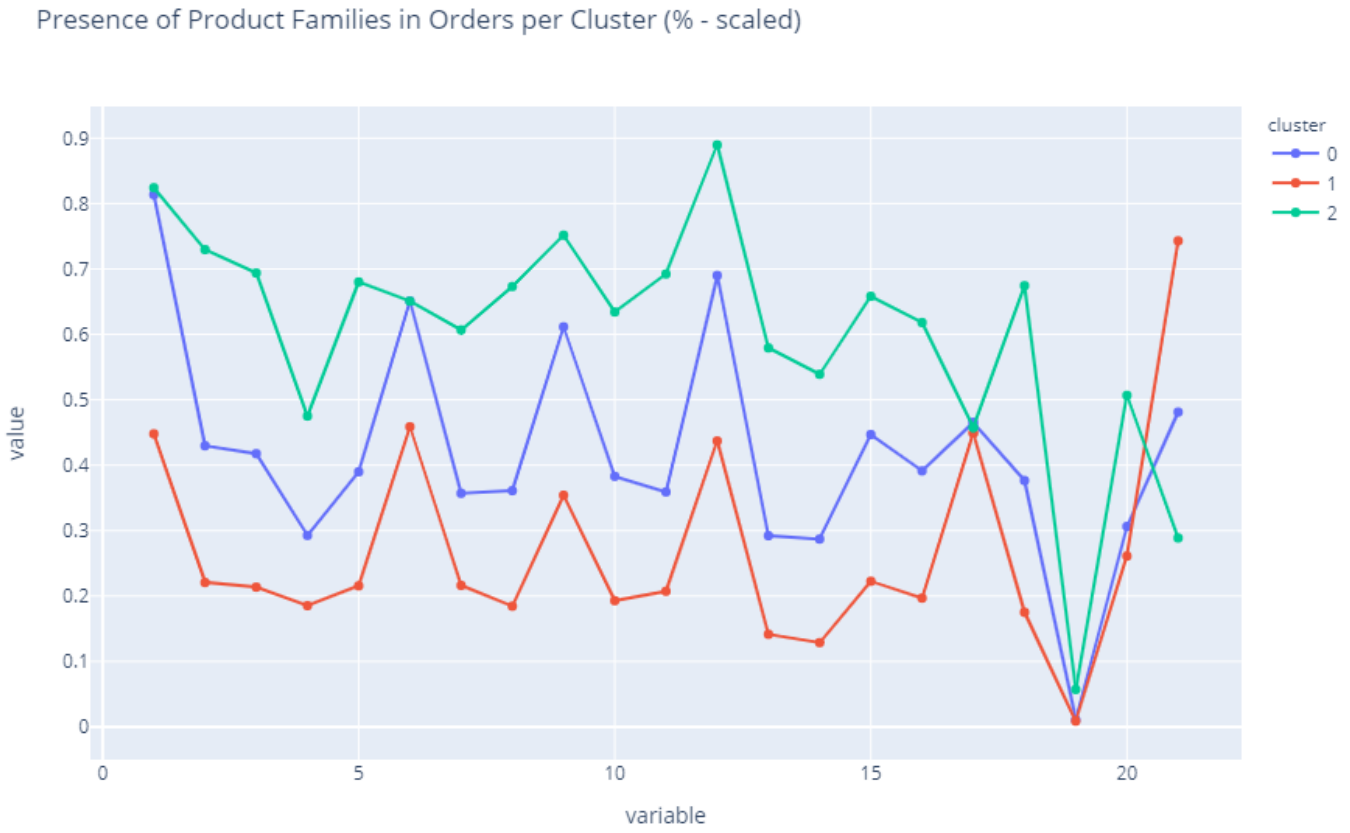
Cluster	Total_Value	Total_Units	ProductFamily_ID	ProductBrand_ID	ProductName_ID
Cluster 0	926312759.01	576697.31	21	133	253
Cluster 1	650379848.28	404556.80	21	133	253
Cluster 2	1258010167.01	775852.29	21	133	253
Cluster 3	404022574.45	250576.04	21	133	253
Cluster 4	1841490763.73	1118103.08	21	1472	253

Cluster 4: highest value, more purchases, top Brand 1472

Clustering

- **Additional Solution (Feature Engineering + K-means)**:

  Family Preference percentage for POS_ID



Predictions

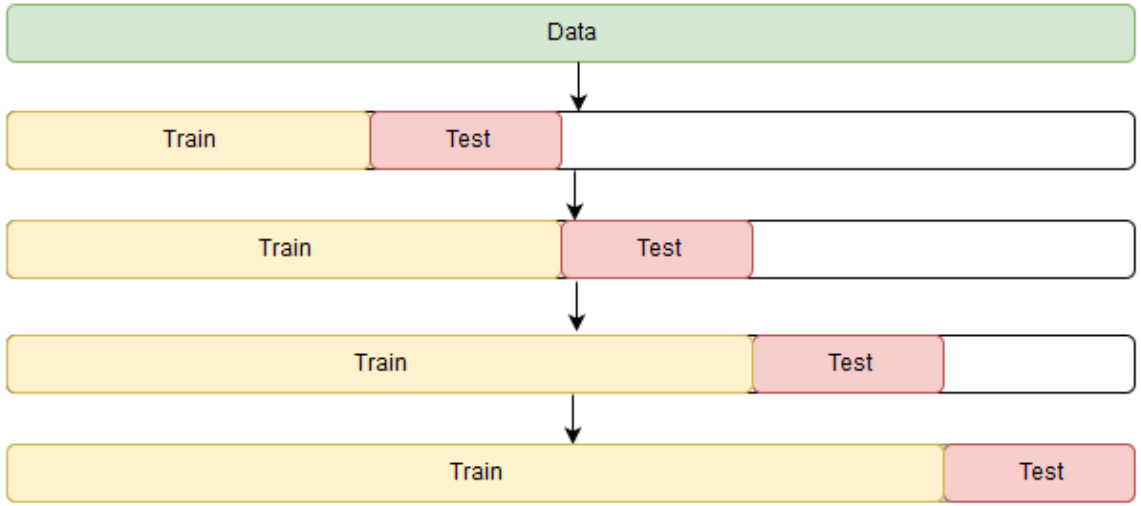
Final preprocessing to trim the number of time series to predict (pair of POS-Product):

Removing discontinued products

3-fold Cross-Validation on a rolling basis

25 algorithms tested

MAE used to select algo for each time series



Predictions

	Model	MAE	MSE	RMSE	R2	RMSLE	MAPE	TT (Sec)	time_series
huber	Huber Regressor	15.2322	455.6069	21.3306	-0.1644	1.0480	1.5959	0.0100	1_993
huber	Huber Regressor	6.7912	114.3427	10.6565	-0.0059	0.8108	1.1844	0.0100	1_356
knn	K Neighbors Regressor	10.8454	296.2128	16.3733	0.5624	0.4765	0.5365	0.0100	1_481
knn	K Neighbors Regressor	12.5603	425.1140	19.9768	0.5030	0.4194	0.3674	0.0067	1_1234
knn	K Neighbors Regressor	12.4270	402.6272	18.7425	0.4651	0.4087	0.3748	0.0100	1_1147

```
{'1_993': HuberRegressor(alpha=0.0001, epsilon=1.35, fit_intercept=True, max_iter=100,
                tol=1e-05, warm_start=False),
 '1_356': HuberRegressor(alpha=0.0001, epsilon=1.35, fit_intercept=True, max_iter=100,
                tol=1e-05, warm_start=False),
 '1_481': KNeighborsRegressor(algorithm='auto', leaf_size=30, metric='minkowski',
                      metric_params=None, n_jobs=-1, n_neighbors=5, p=2,
                      weights='uniform'),
 '1_1234': KNeighborsRegressor(algorithm='auto', leaf_size=30, metric='minkowski',
                      metric_params=None, n_jobs=-1, n_neighbors=5, p=2,
                      weights='uniform'),
 '1_1147': KNeighborsRegressor(algorithm='auto', leaf_size=30, metric='minkowski',
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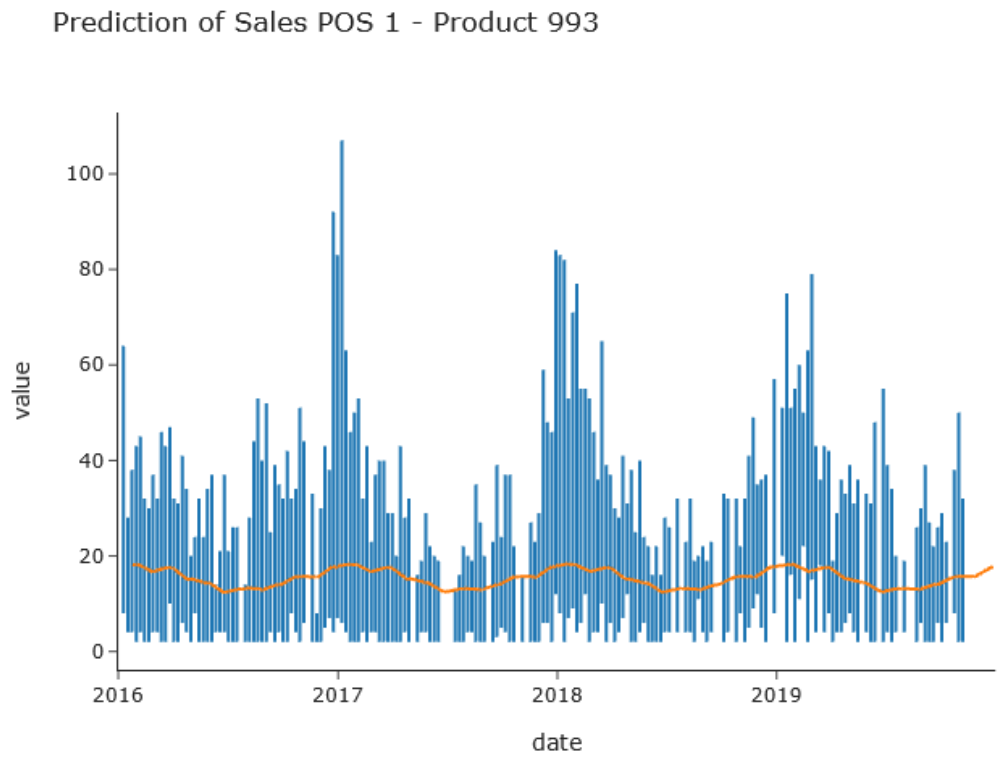

Last remarks on VAR for COVID impact

Thank you!