Car Insurance

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Sumo report - expectations

Sumo report - reality

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Deeper look into data set
Column approach

Reminder

What the hell is this competition about ???

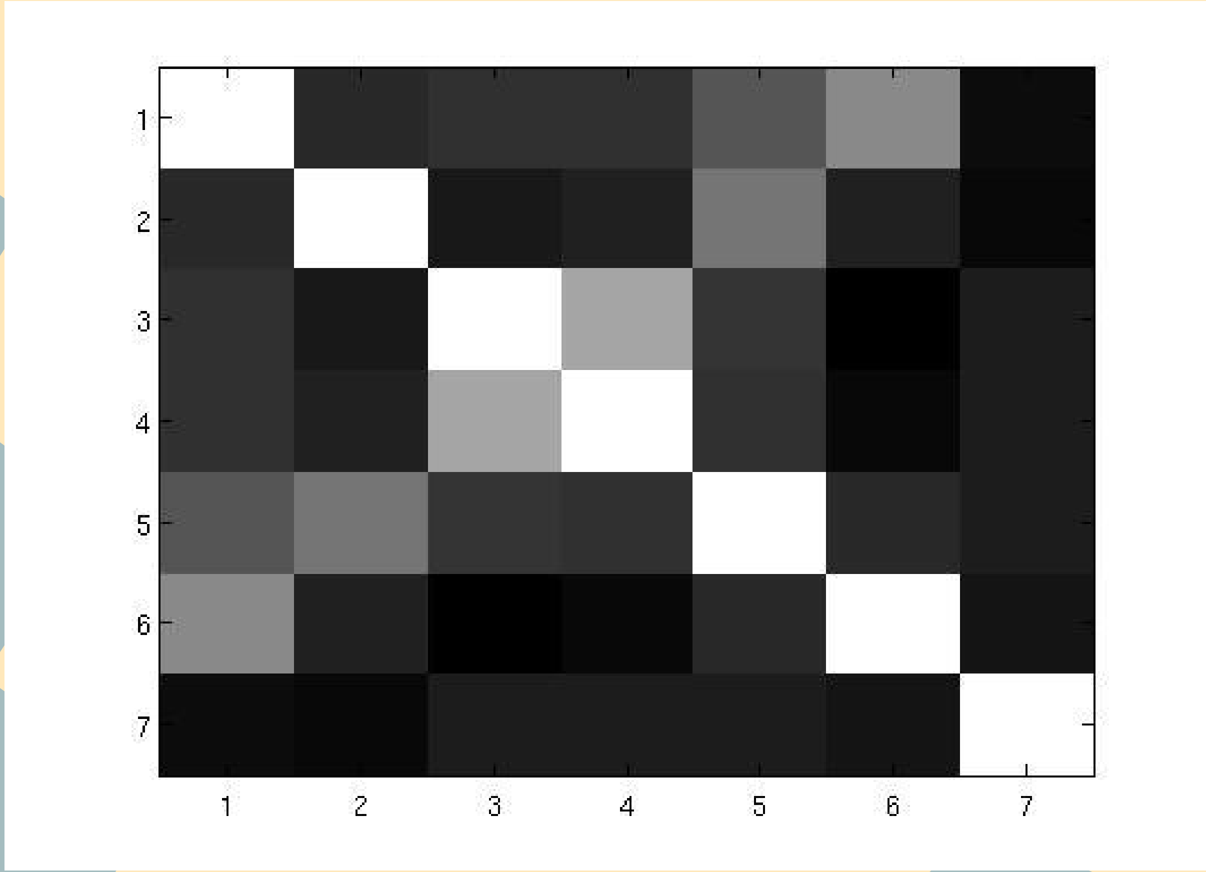
Attributes overview

customer_ID, **record_type**, dateTime, location, group_size, homeowner, car_age, **car_value**, **risk_factor**, **age_oldest**, age_youngest, married_couple, **C_previous**, duration_previous, **A,B,C,D,E,F,G**, cost

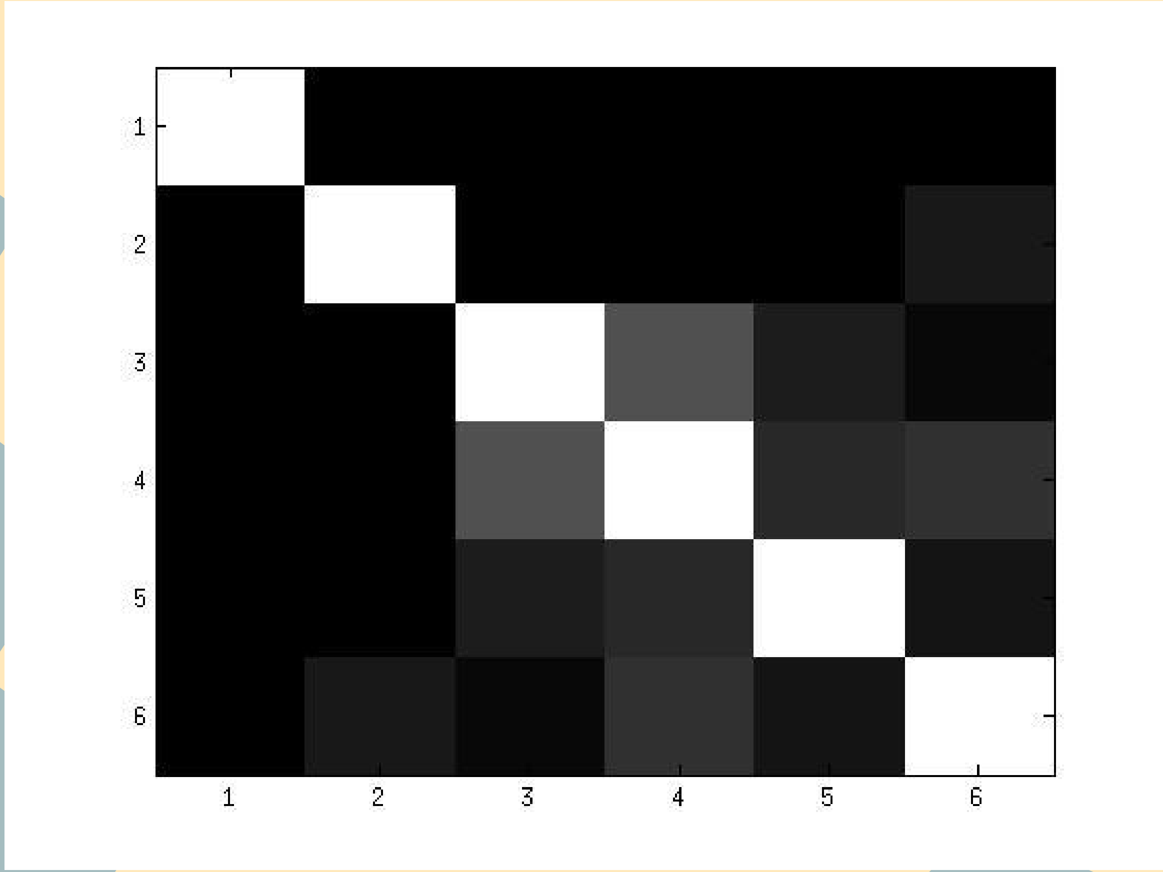
Data problems

- lot of nan values in
  - risk factor
  - c_previous
  - nan values replaced with 0
- some attributes have to big granularity
  - date time
    - probably no need to use at all

Column correlation 1



Column correlation corr([location risk_factor cost A B C])



Correlation result

- almost no linear dependency
- no chance to categorize with linear regression
- we need to add at least quadratic/cubic coefficients or use svm machines with clever kernel function

Column approach Motivation

- last quotes benchmark 53%
- 72% buys previously visited product
- Can we bring our result nearer to 72% ?
- average gives 45%
  - need something more clever
  - older are more important than previous views
    - weighted average instead

Future work

- better data filter and normalization
- clever column approach
- keep compatibility with our interface for result combinations
- don’t ever try to win sumo competition again

.Net & Horizontal data view

Štěpán Havránek

Machine learning & .Net

- Accord framework
  - http://accord-framework.net
  - Complex Computer science library
    - Math
    - Statistics
    - Machine learning
    - Neural networks
  - Uniform interface
  - Various data manipulation utilities

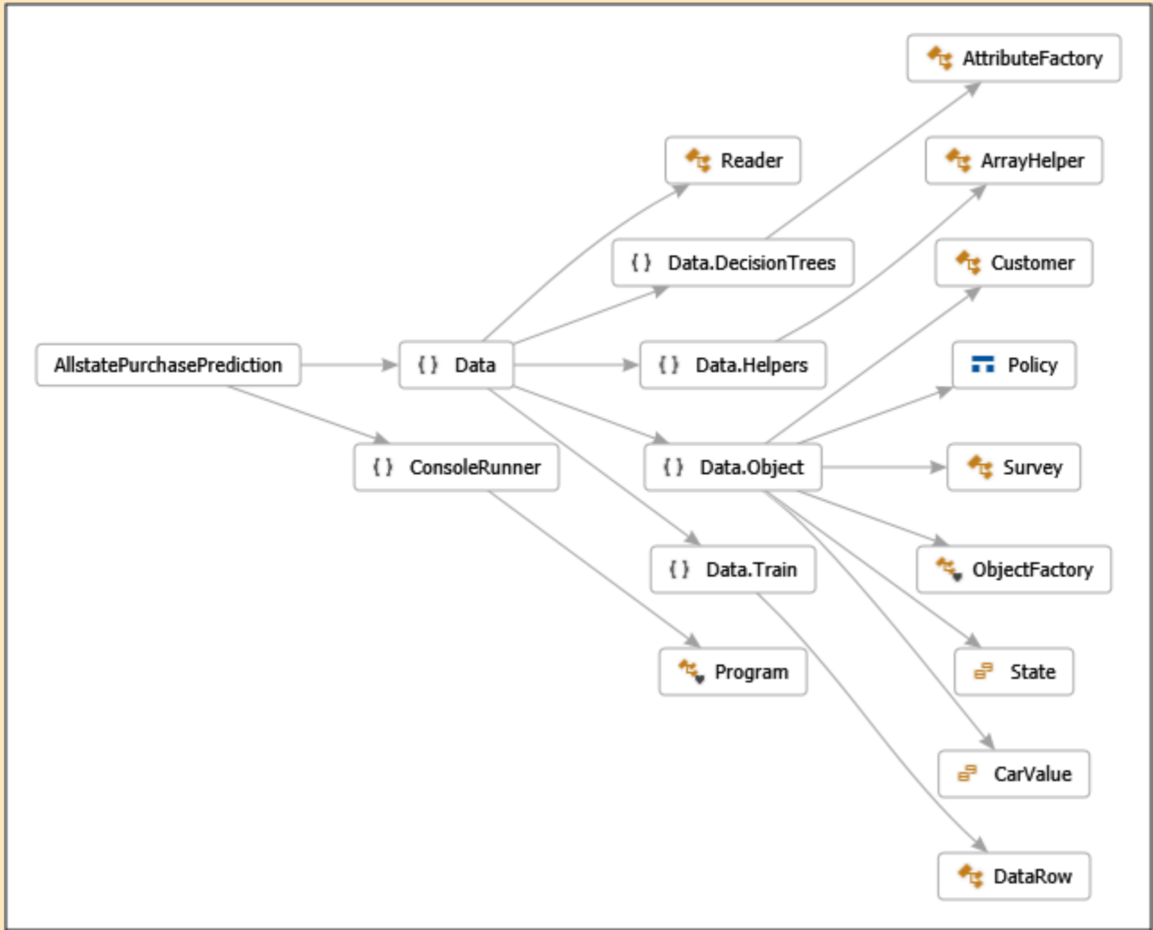
Machine learning & .Net

- AForge framework
  - http://www.aforgenet.com/
  - Primary for computer vision
  - Libraries for Computer Science
    - Especially Artificial intelligence

.Net implementation

- Data in MS SQL Server
    - Easy to fetch, aggregate, view, etc...
- Object model and object factory
    - Easy to transform
    - Made in Object Factory

.Net implementation



Data horizontal view

- What the customer info can say about the result purchased product parameters?
  - Seven output parameters
    - mostly 4 options per each
- Let’s try to make a model only on customer parameters and verificate it

Data horizontal view

- Decision trees
  - Input attributes
    - Customer and his car info
      - Ages
      - Car value
      - Group size
      - Is homeowner
      - Is married
      - Risk factor
      - Previous purchase info

Data horizontal view

- Decision trees
  - Used learning algorithms
    - ID3
    - C4.5
- Model verification
  - 10 times cross validation
    - => 10 different models (trees)
  - Process
    - Split the data
    - Create (learn) model
    - Validate outputs

Data horizontal view

- Results
  - 50 - 79% mean validation error
    - Actual competition leader has score 54%
  - At least two output parameters (A, E) are very dependent on customer
  - C, D are less dependent
  - B, F, G can’t be resolved from the customer info

Future work

- Environment for experiments is ready…
- Spread out the horizontal data object
  - Add product browsing history
- Divide the output parameters between different models and input parameter sets
- Pruning overfits
- Use as much as possible from the Accord Framework
  - Unify interfaces, lots of data and ML utilities

Michal Pokorný

SVC model

scikit-learn

- Python (3)
- NumPy, SciPy, matplotlib
- BSD licence

- Classification, regression, clusterization, dimensionality reduction, cross-validation, ...

Current plan

- Most customers choose some browsed plan
- Make some predictors of plan choice probabilities
- From browsed plans, pick the one with highest probability prediction

Plan probability predictor

- RBF support vector machine classifier
  - (Plus feature scaling)
- Possible features:
  - Vector of “customer constants” (no location & time for now)
  - Most commonly browsed plan, last browsed plan, …
  - Histogram of browsing for every plan feature

Closer look on features

- One-hot
  - Day, previous C, home owner?, married couple?
  - A: 3, B: 2, C: 4, D: 4, E: 2, F: 4, G: 4
- Scalar
  - Group size, car age, car value, risk factor, age of oldest & youngest, cost of offer

Results so far

- Relatively slow training on all 77607 customers :(
- Current best result: 53.793% (same as trivial benchmark [doesn’t give the same outputs, through])
    - But this was on scalar representations of categories, so there might be some progress after training on better representation finishes :)

Scalar vs. one-hot (small dataset)

	precision	recall	f1-score	support
0	0.81	0.45	0.57	56
1	0.67	0.97	0.80	181
2	0.00	0.00	0.00	55
avg / total	0.57	0.69	0.60	292

	precision	recall	f1-score	support
0	0.81	0.45	0.57	56
1	0.67	0.97	0.80	181
2	0.00	0.00	0.00	55
avg / total	0.57	0.69	0.60	292

	precision	recall	f1-score	support
0	0.53	0.38	0.44	146
1	0.52	0.66	0.58	146
avg / total	0.52	0.52	0.51	292

	precision	recall	f1-score	support
0	0.53	0.38	0.44	146
1	0.52	0.66	0.58	146
avg / total	0.52	0.52	0.51	292

	precision	recall	f1-score	support
0	0.52	0.43	0.47	79
1	0.00	0.00	0.00	64
2	0.50	0.90	0.64	125
3	0.00	0.00	0.00	24
avg / total	0.35	0.50	0.40	292

	precision	recall	f1-score	support
0	0.96	0.95	0.95	56
1	0.93	0.99	0.96	181
2	0.98	0.78	0.87	55
avg / total	0.94	0.94	0.94	292

	precision	recall	f1-score	support
0	0.94	0.93	0.93	146
1	0.93	0.94	0.94	146
avg / total	0.93	0.93	0.93	292

	precision	recall	f1-score	support
0	0.94	0.96	0.95	79
1	0.95	0.86	0.90	64
2	0.92	0.98	0.95	125
3	0.95	0.79	0.86	24
avg / total	0.94	0.93	0.93	292

	precision	recall	f1-score	support
0	0.77	0.97	0.86	31
1	0.97	0.88	0.92	69
2	0.98	0.97	0.97	192
avg / total	0.95	0.95	0.95	292

What’s next?

- “Naive Bayes assumption”: category membership classifier scores are multiplied...
  - Higher-order classifiers?
- Do something about missing values
  - scikit Imputer
- Throw in more features if nothing works...
- Ensemble if something works...