ECML-PKDD 2015

BIKE SHARING MODEL REUSE FRAMEWORK

FOR TREE-BASED ENSEMBLES

energyforecasting.io

dmlab

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MOREBIKES - MODEL REUSE WITH BIKE RENTAL STATION DATA

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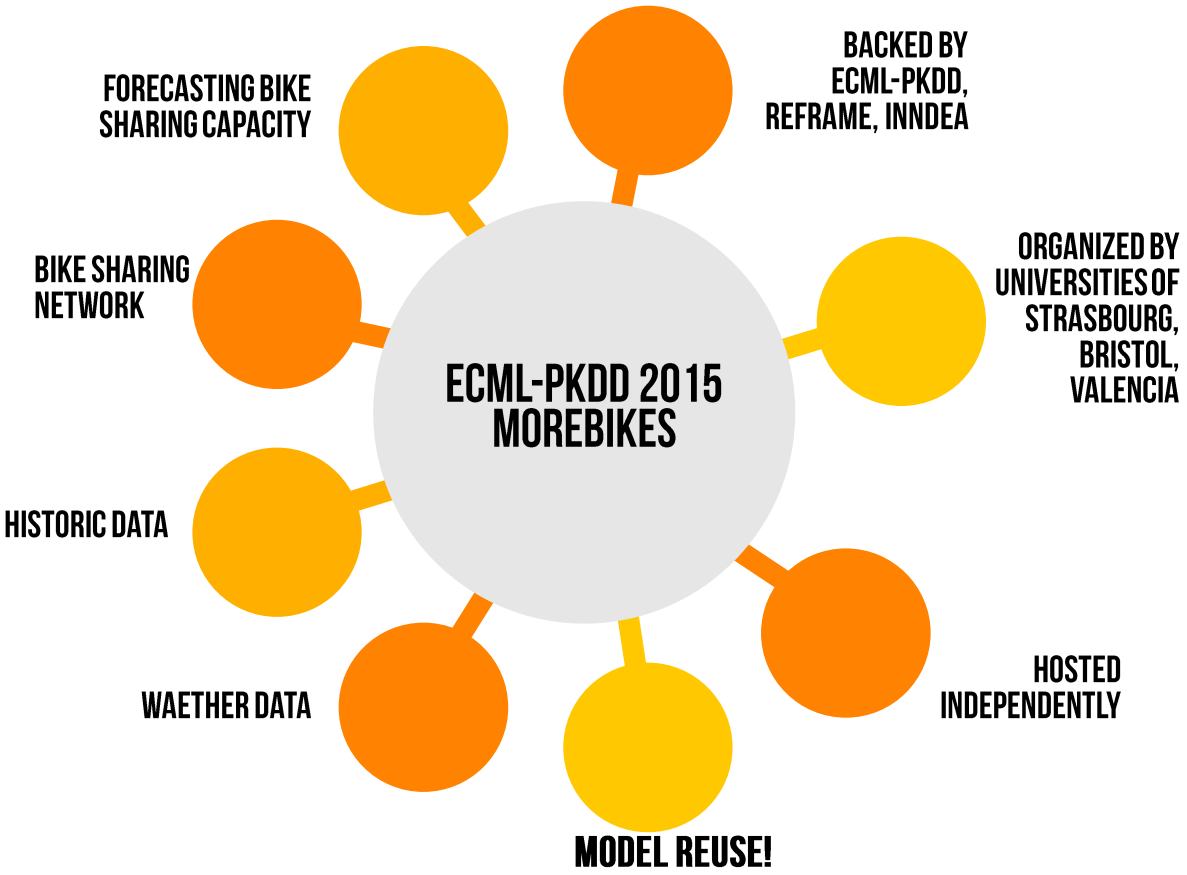

3RD PLACE
WIND POWER FORECASTING
GEFCOM 2012

2ND PLACE
ELECTRIC LOAD FORECASTING
RWE NPOWER 2015

2ND PLACE
SOLAR & WIND POWER FORECASTING
GEFCOM 2014

MOTIVATION

ERASMUS, VLC, 2009

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WIND POWER FORECASTING
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2ND PLACE
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RWE NPOWER 2015

2ND PLACE
SOLAR & WIND POWER FORECASTING
GEFCOM 2014

CHALLENGE APPROACH

THE DATA

1. 1-10  2.5 YRS
2. 11-200  1 MONTH
3. 201-275  1 MONTH  3 MONTHS TEST
4. BASELINE & LINEAR MODELS 
5. ERROR RATES 

THE DATA

1. 1-10
2. 11-200 1 MONTH
3. 201-275 1 MONTH
4. BASELINE & LINEAR MODELS
5. ERROR RATES

3 MONTHS TEST

EXPLORING THE DATA

1. BIKE SHARING NETWORK
2. OBSERVING BEHAVIOUR
3. +/- CORRELATIONS (PEARSON,DTW)
4. STANDARDIZE DATA BY STATION SIZE

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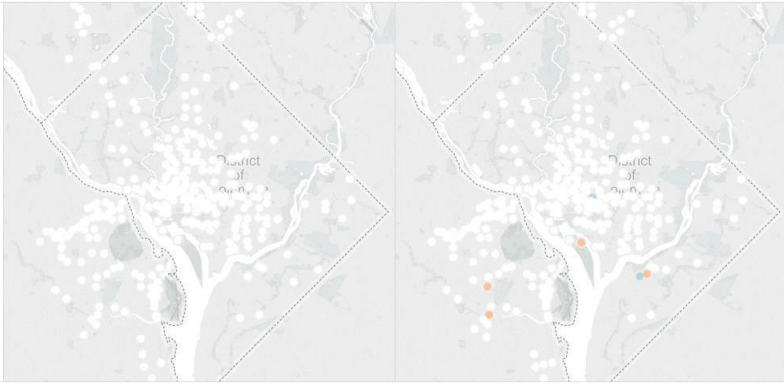

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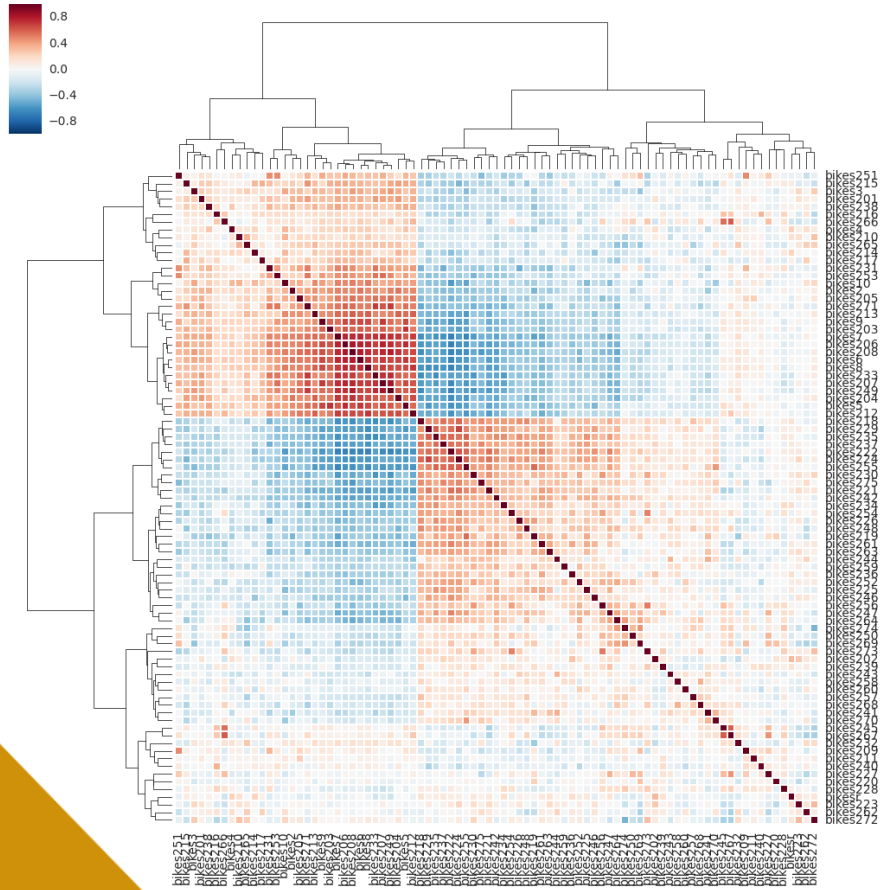

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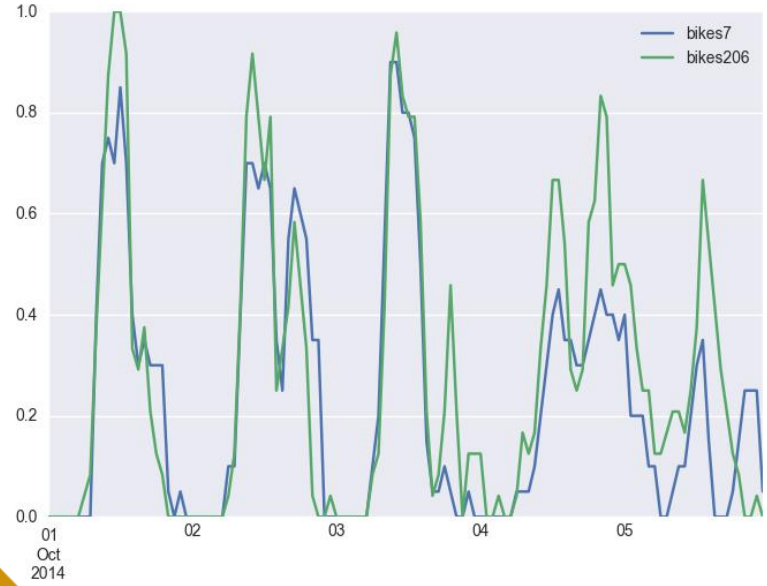

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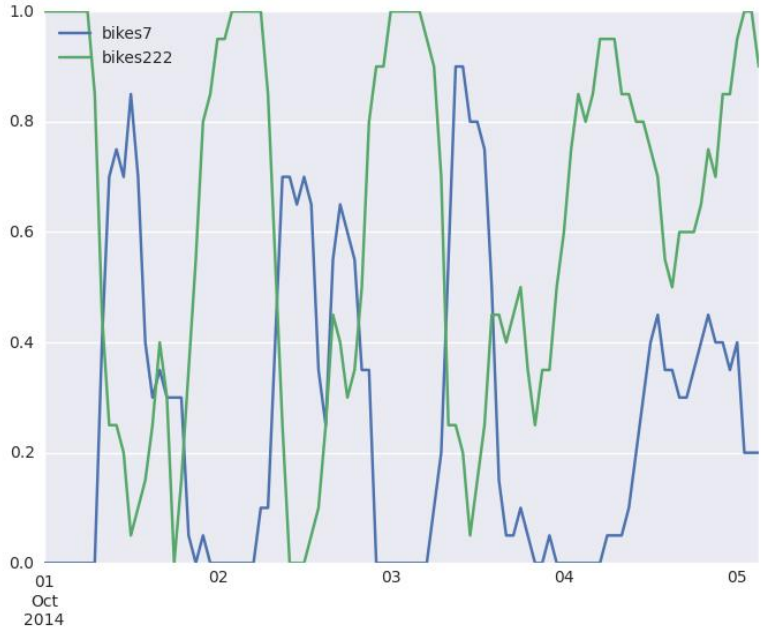
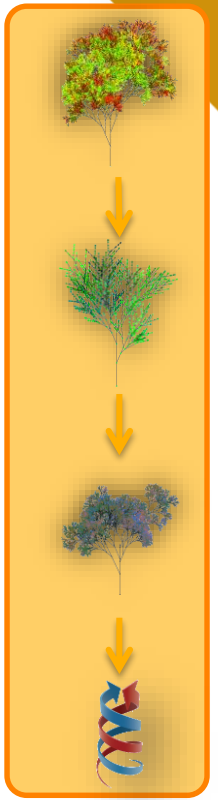


FRAMEWORK ARCHITECTURE



GRADIENT BOOSTING REGRESSOR

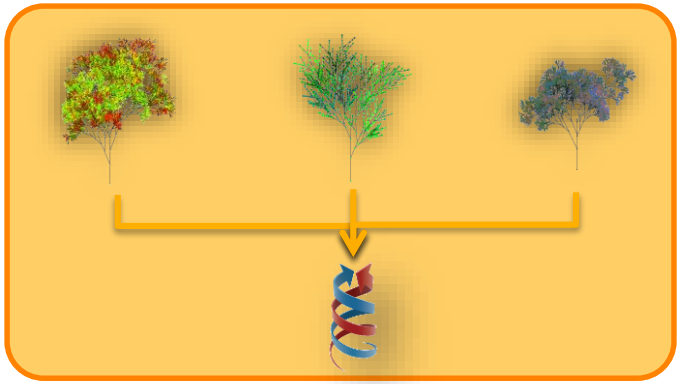
1. FRIEDMAN, 1999
2. ROBUST COMBINATION OF WEAK LEARNERS
3. RESISTANT TO OVERFITTING, FEW TUNING PARAMETERS, PROVIDES VARIABLE IMPORTANCE
4. QUANTILE REGRESSION CAPABLE!
5. EMPLOYS BOOSTING

STACKING

GBR + RF

7 BASELINE MODELS

ENSEMBLING



RANDOM FOREST REGRESSOR

1. BREIMAN, 2001
2. ROBUST COMBINATION OF WEAK LEARNERS
3. RESISTANT TO OVERFITTING, FEW TUNING PARAMETERS, PROVIDES VARIABLE IMPORTANCE
4. QUANTILE REGRESSION CAPABLE!
5. EMPLOYS BAGGING

CHALLENGES

1. DEVELOP A LOCAL VALIDATION SCHEME
2. INCLUDE RELEVANT INFORMATION
3. REDUCE NOISE
4. INCREASE ACCURACY

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SOLUTION

- 2 EVALUATION PERIODS: H2 & Q4 OCT
- PERFORMS SUPRISINGLY WELL

CHALLENGES

1. DEVELOP A LOCAL VALIDATION SCHEME
2. INCLUDE RELEVANT INFORMATION
3. REDUCE NOISE
4. INCREASE ACCURACY

SOLUTION

- FIND SUITABLE TRAINING SET DONORS (PEARSON)
- SWAP CAPACITY ATTRIBUTES, INCLUDE NEGATIVELY CORRELATED DONORS

Input variable	Transformation applied
bikes	1 - bikes
bikes_3h_ago	1 - bikes_3h_ago
full_profile_bikes	1 - full_profile_bikes
short_profile_bikes	1 - short_profile_bikes
short_profile_3h_diff_bikes	(-1) * short_profile_3h_diff_bikes
full_profile_3h_diff_bikes	(-1) * full_profile_3h_diff_bikes

CHALLENGES

1. DEVELOP A LOCAL VALIDATION SCHEME
2. INCLUDE RELEVANT INFORMATION
3. REDUCE NOISE
4. INCREASE ACCURACY

SOLUTION

- INDIVIDUAL MODEL(!) FOR EACH TEST CASE (500)
- W/ SAME PARAMETERS
- DISCARD IRRELEVANT DATA POINTS
- EFFICIENT NEAREST NEIGHBOUR APPROACH (KDTREE)

CHALLENGES

1. DEVELOP A LOCAL VALIDATION SCHEME
2. INCLUDE RELEVANT INFORMATION
3. REDUCE NOISE
4. INCREASE ACCURACY

SOLUTION

- 3-FOLD OPTIMIZATION USING LOCAL CV
  - TRAINING SET DONOR SELECTION
  - MODEL PARAMETERS (2X)
  - NEAREST NEIGHBOURS

METHOD EVOLUTION & RESULTS

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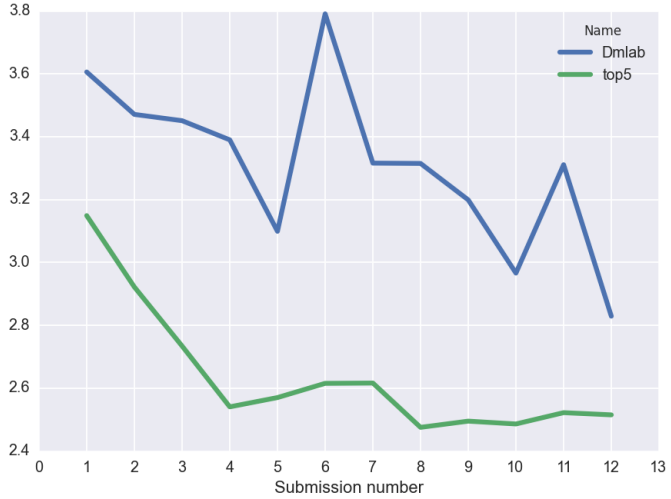
LEDERBOARD SCORE BY SUBMISSION



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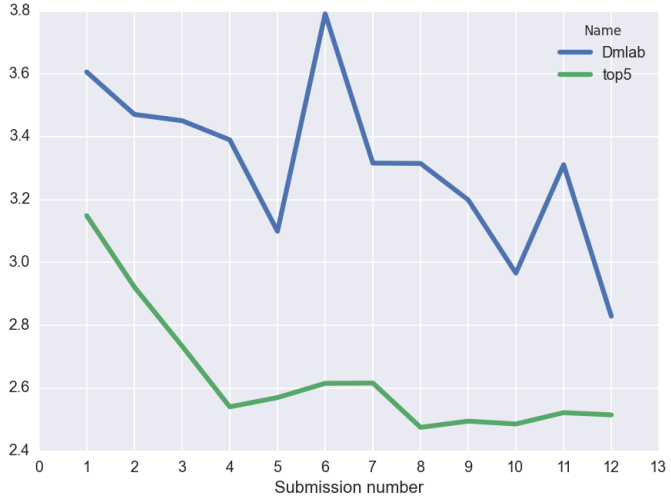

OCTOBER DATA ONLY (BASELINE)

METHOD EVOLUTION & RESULTS

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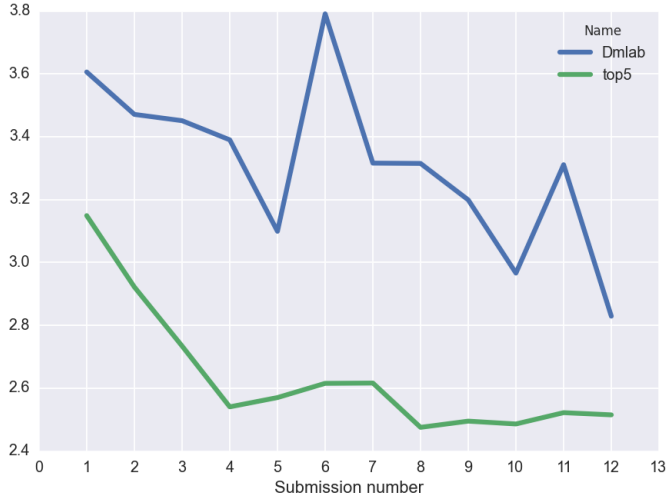

NEGATIVE CORRELATIONS

METHOD EVOLUTION & RESULTS

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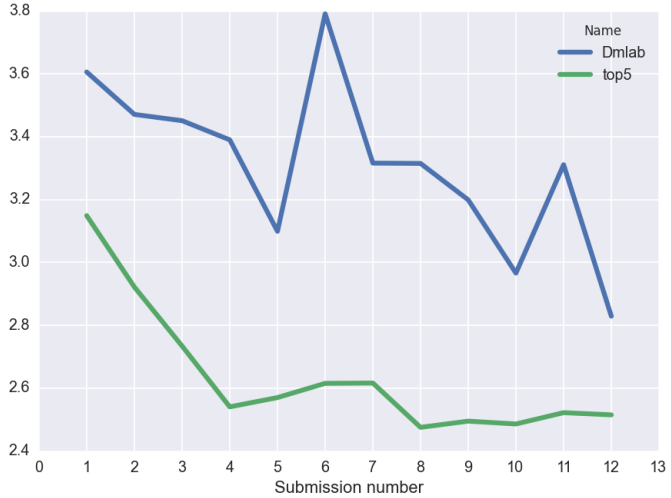

EXPERT MODELS + NEIGHBOUR FILTERING

METHOD EVOLUTION & RESULTS

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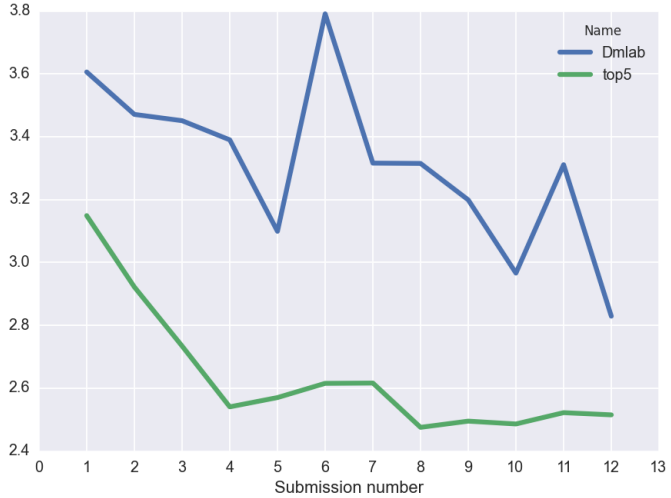

OPTIMIZING NEIGHBOUR ATTRIBUTES

METHOD EVOLUTION & RESULTS

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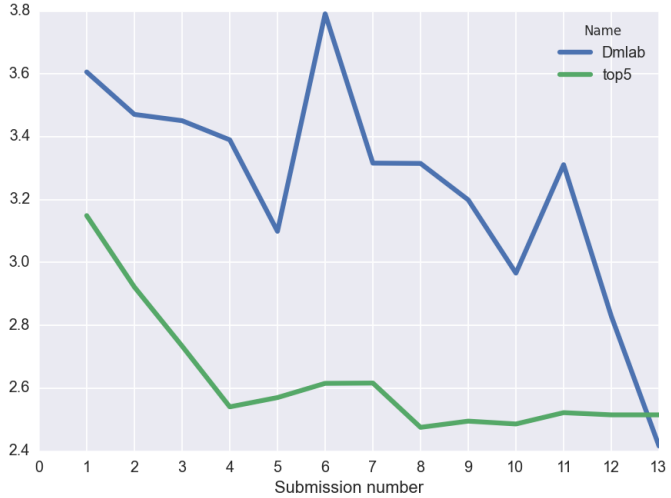

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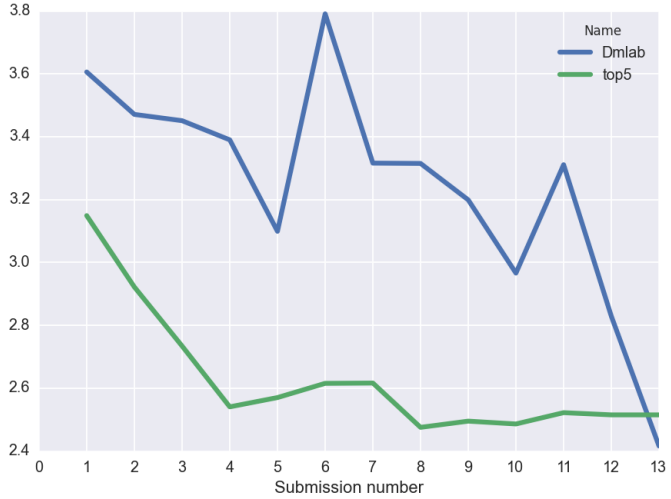
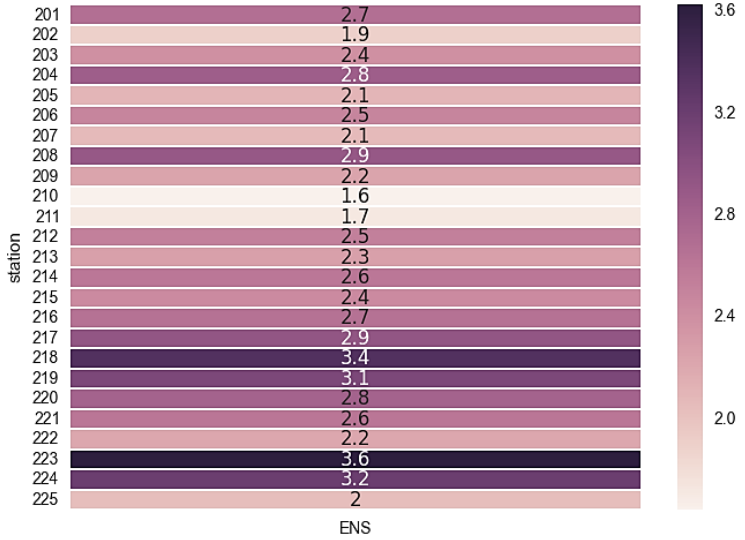


LOCAL CV ERROR BY STATION



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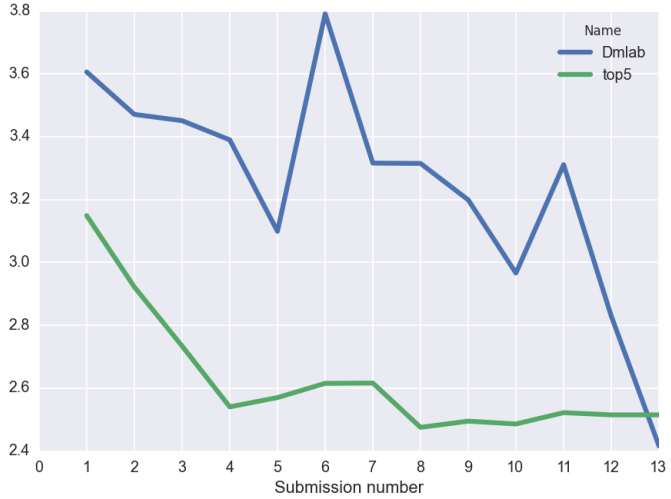

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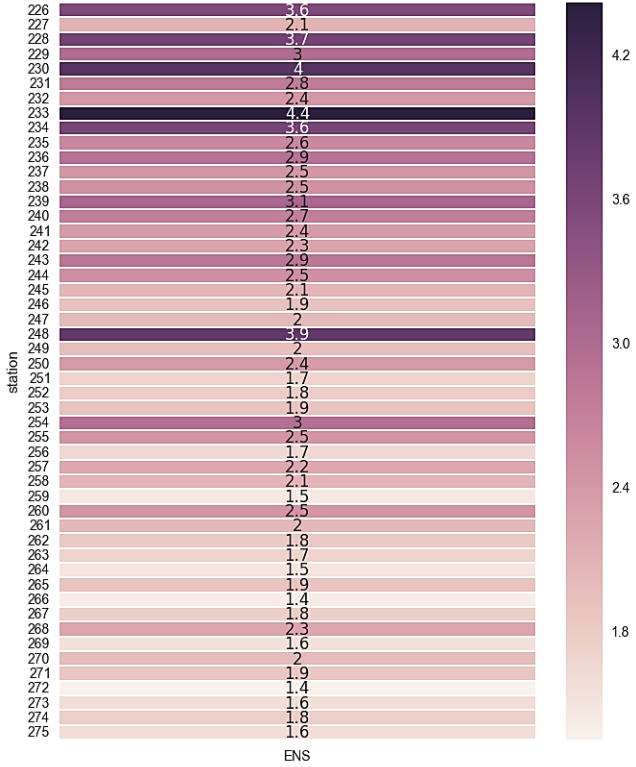

THE DATA

1. 1-10
2. 11-200 — 1 MONTH
3. 201-275 — 1 MONTH — 2-3 MONTHS TEST
4. BASELINE & LINEAR MODELS
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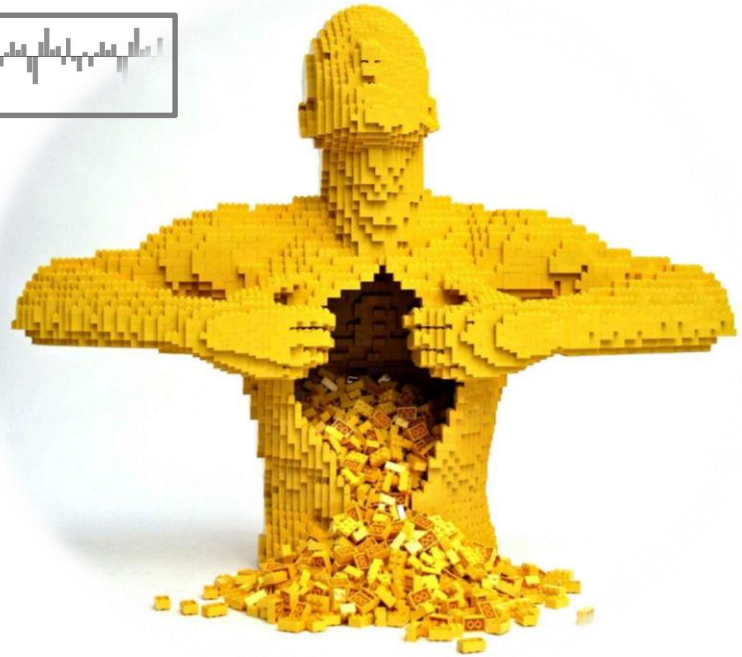

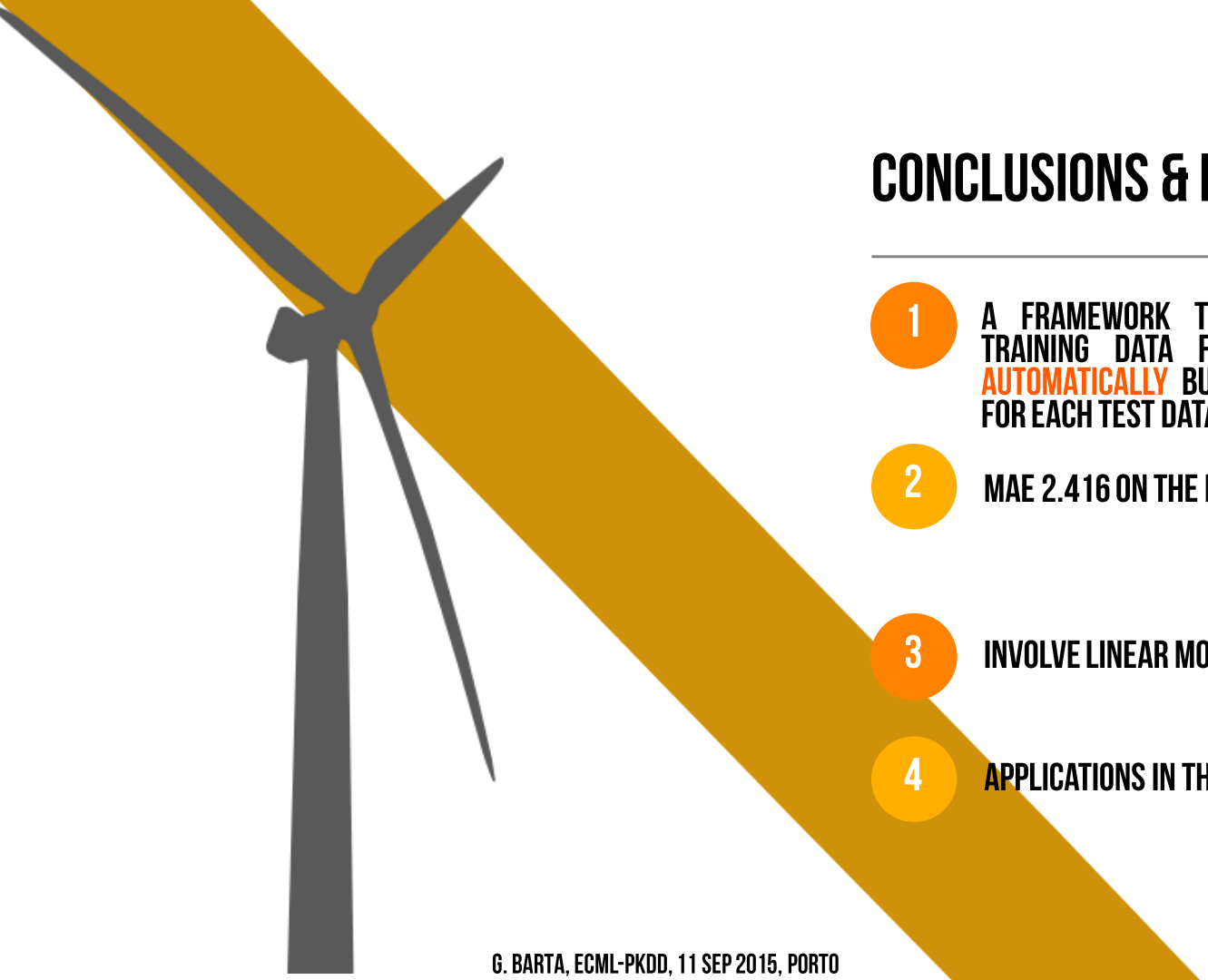

CONCLUSIONS & FUTURE WORK

1. A FRAMEWORK THAT EFFICIENTLY PICKS SUITABLE TRAINING DATA FROM A LARGE POPULATION AND AUTOMATICALLY BUILDS ACCURATE ENSEMBLE MODELS FOR EACH TEST DATA POINT
2. MAE 2.416 ON THE FINAL TEST SET
3. INVOLVE LINEAR MODELS (STACKING, FALLBACK)
4. APPLICATIONS IN THE ENERGY FIELD (WIND)

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THANK YOU FOR YOUR KIND ATTENTION

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