



Modeling Maternal Mortality Rates (MMR)

Data Science Part Time Course
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What factors contribute to global MMR?

PROBLEM STATEMENT:

Can I predict which socioeconomic and public health initiatives will improve global maternal mortality rates?



Could other factors contribute to MMR?

Datasets

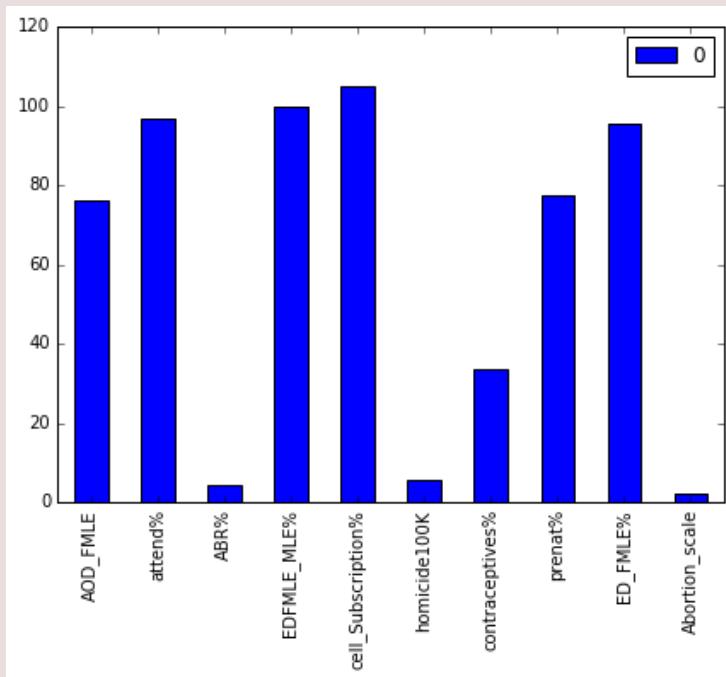
Maternal Mortality Rates (MMR):

- A. Birth attendant
- B. Antenatal (prenatal) care
- C. Adolescent Birth Rates
- D. Contraceptives modern methods
- E. Abortion policy scale
- F. Education: Primary School Enrollment
- G. Technology: Cellphone Subscribers
- H. War: Homicides
- I. Health: Life Expectancy
- J. Wealth: GNI Per Capita Data by Country(PPP)



Dataframe and Feature Engineering

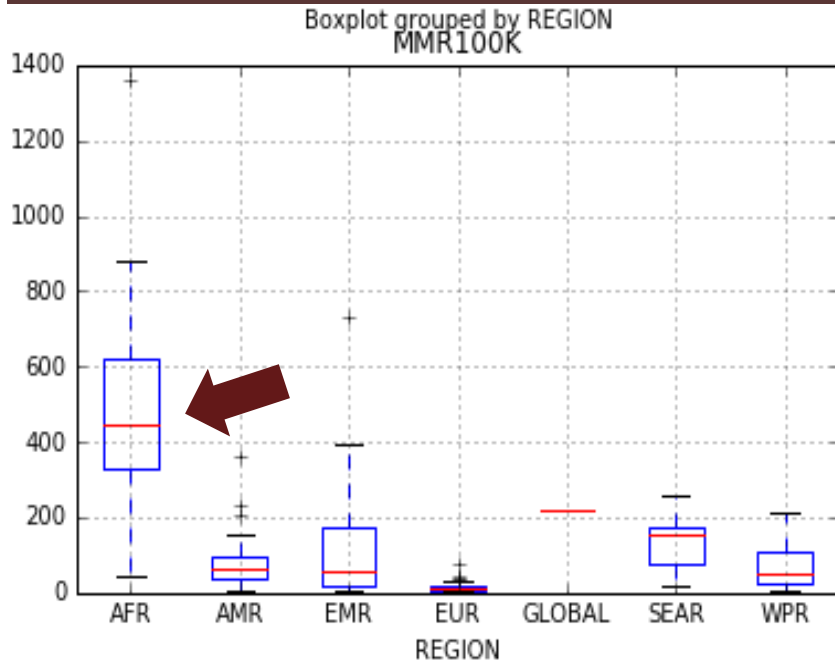
- 190 countries
- 12 different datasets, 33 total columns
- Missing data filled with median values:



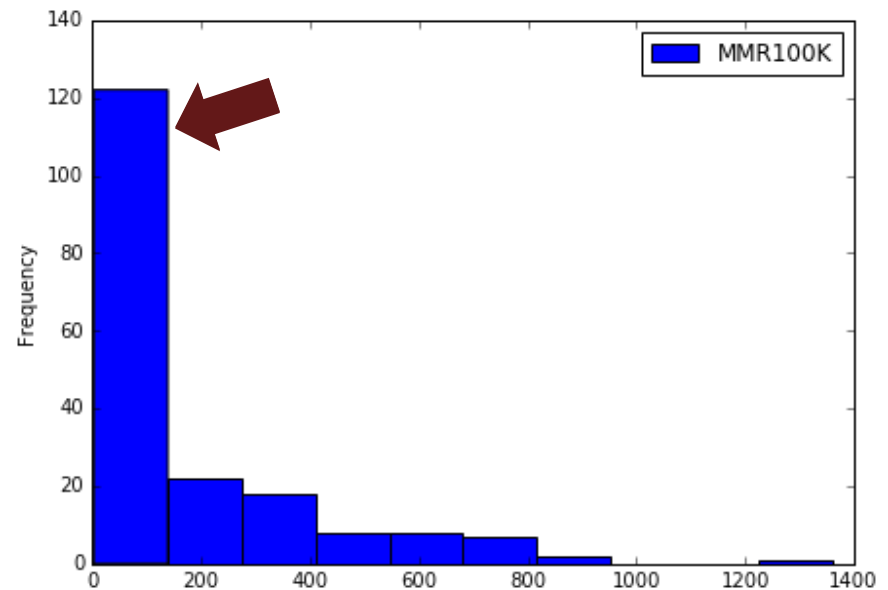
AOD_FMLE	76.06
attend%	96.60
GNI	10080.00
ABR%	4.54
EDFMLE_MLE%	99.82
cell_Subscription%	105.00
homicide100K	5.40
contraceptives%	33.73
prenat%	77.60
ED_FMLE%	95.37
Abortion_scale	2.00

Response Variable Engineering

Regional MMR



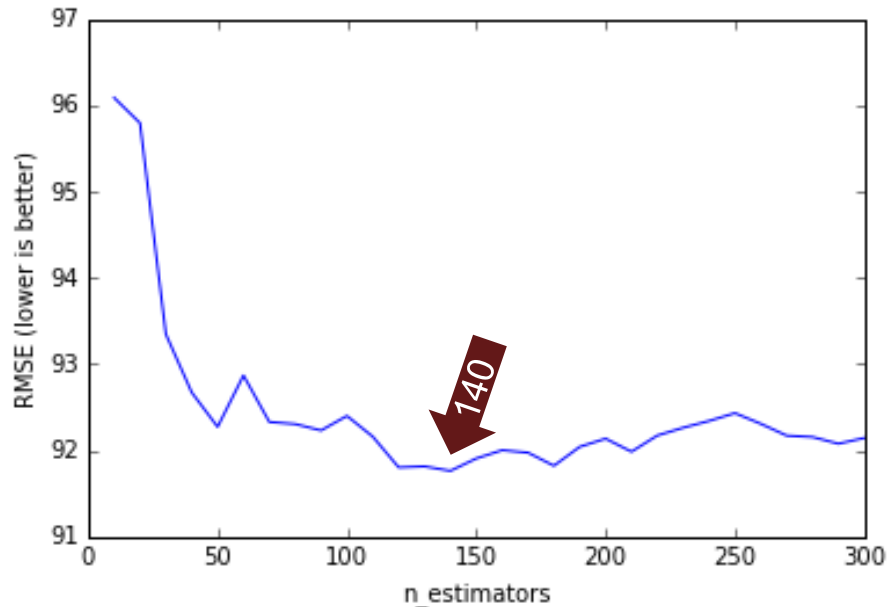
MMR Frequency



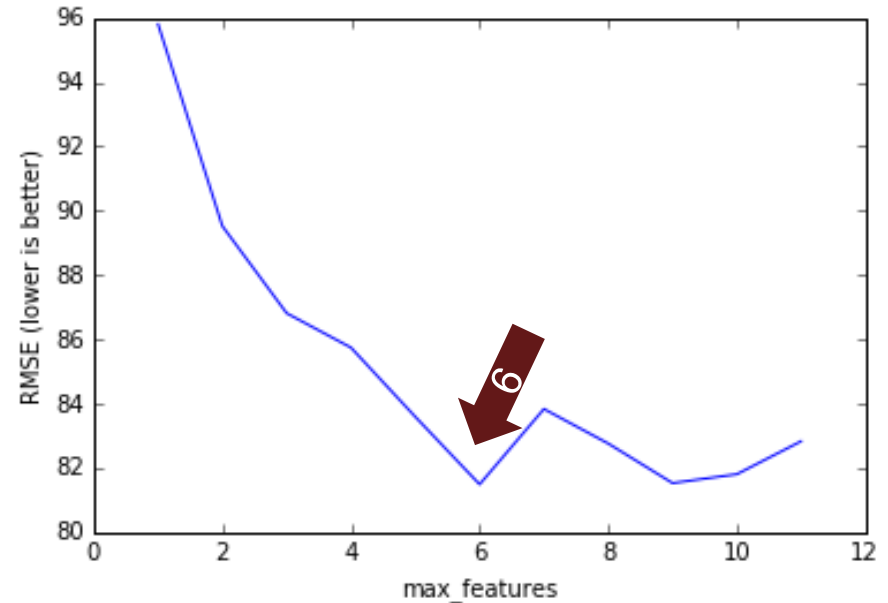
1. MMR100K - Maternal deaths per 100,000 births
2. MMRClassifier - Created for logistic regression model based on min, max and 25, 50, 75% of MMR.
3. MMRBinary - Binary variable for logistic regression model.

Optimizing Features: Random Forest Regressor

Estimator Tuning



Feature Tuning



- RMSE total : 91.88
- RMSE optimized : 82.65
- Optimized demographics: Life expectancy, adolescent BR, education, cell subscriptions, birth attendant, GNI

Model Comparisons

Model	Null	Log Reg	Log Reg (Optimized	Ran For	Ran For (Optimized
MMRBinary	0.526316	0.873684211	0.857894737	0.8895	0.8947
MMRClassifier	0.268421	0.692464986	0.674336644	0.7558	0.7482
MMR100K (<u>oob</u>)	0.052632	Na	Na	<u>0.815</u>	<u>0.8348</u>

Selection of demographics: 'ABR%', 'AOD_FMLE', 'GNI', 'EDFMLE_MLE%', 'cell_Subscription%', 'attend%'.

- All of the models improve null accuracy.
- The random forest classifier performs better than the logistic regression model.
- Reducing the number of demographics improves model accuracy.
- *The random forest regressor model is the only model run that produces MMR predictions.*

Conclusions

OPTIMIZED FEATURES included in the model:

- * AOD_FMLE - 0.810598
- * attend% - 0.077110
- * GNI - 0.029861
- * ABR% - 0.019747
- * EDFMLE_MLE% - 0.012234
- * cell_Subscription% - 0.011530

Features excluded from the model:

- * ED_FMLE% - 0.011345
- * prenat% - 0.010079
- * homicide100K - 0.008285
- * contraceptives% - 0.006246
- * Abortion_scale - 0.002966

Demographic contributions to model:

- Successful hypothesis: Education
- Surprising outcomes: Abortion policy, cell phone subscriptions

Future Work

- Build a model that lacks well known causal demographics and determine the predictability.
- Add more demographics, here are some potential data sets to improve the model from WHO.