The US Army's Physical Fitness Test (APFT) in Infantry Basic Training

An exploration on why there is a high initial failure rate

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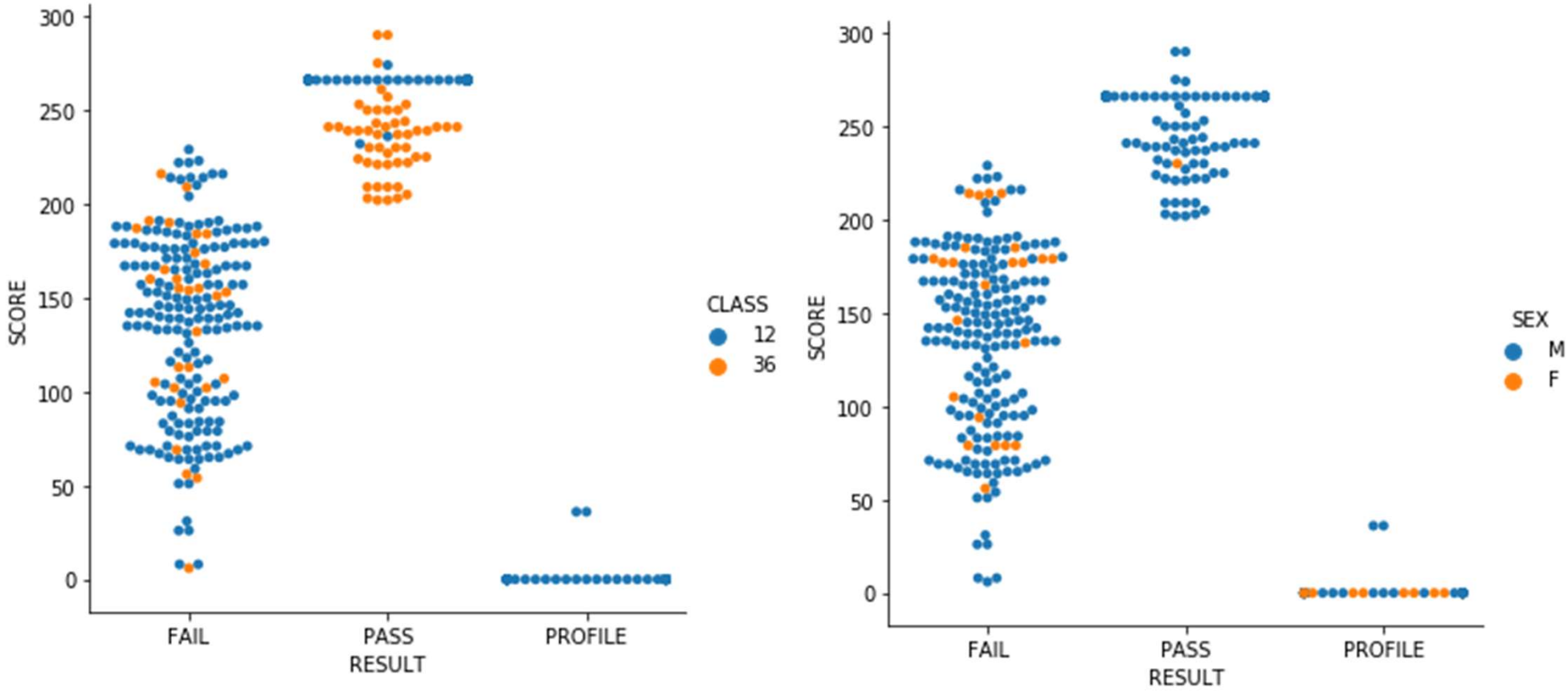
Thesis

Can we predict pass or fail by only looking at specific exercises within the APFT?

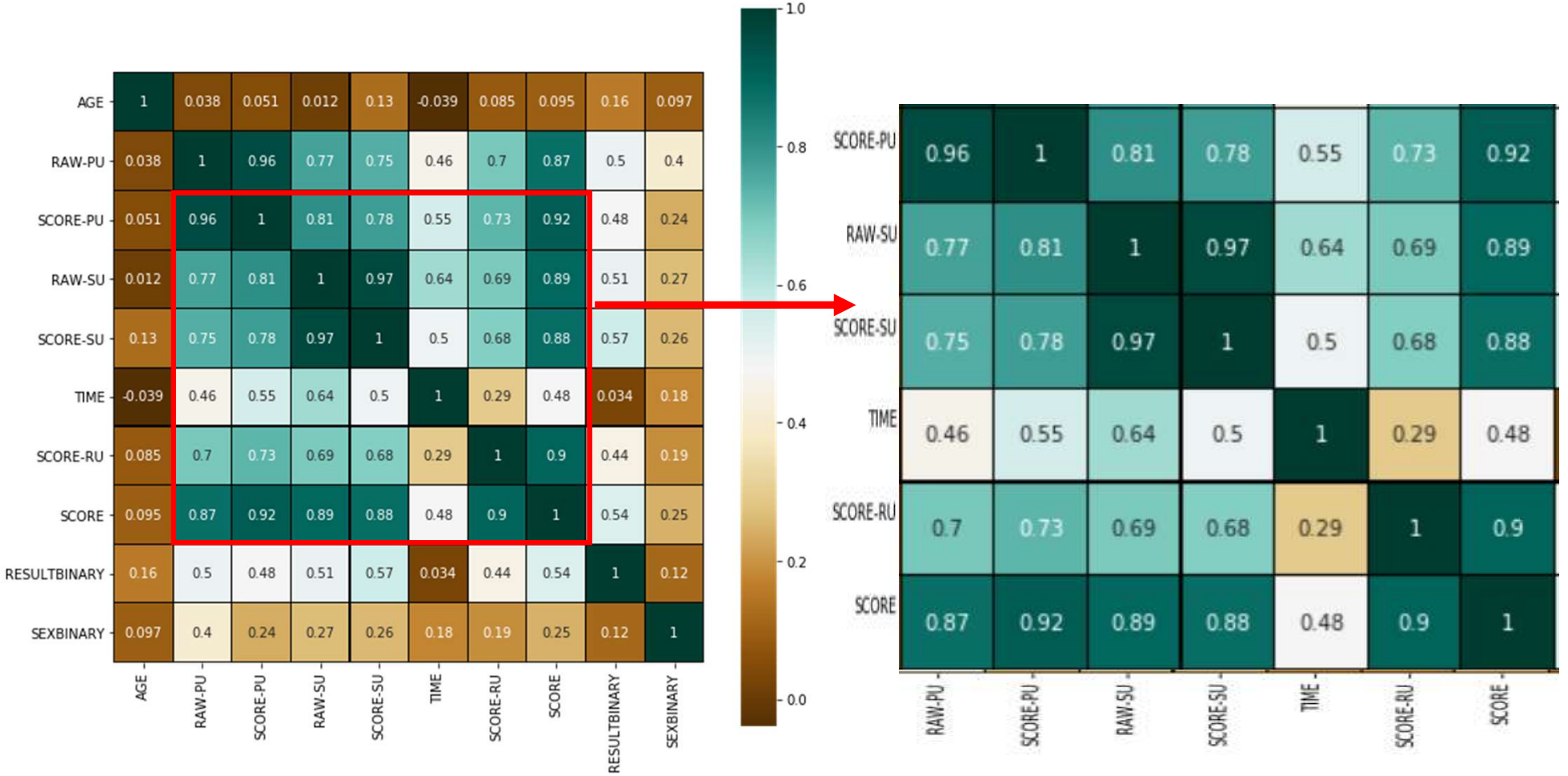
Background

- Data Background
  - APFT Consists of 3 Events in order:
  - Push ups (RAW PU), Sit ups (RAW SU), and Running (TIME)
  - Converted into scores pending on age-bracket (Score-PU, Score-SU, SCORE-RU) which is calculated into an overall (SCORE)
  - Minimum of 60% in all categories with a minimum of overall score of 180 to pass (RESULTBINARY) to a maximum of 300

Current Initial APFT Score



What are the Important Factors in the APFT?



OLS Regression Results

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	-0.0366	0.104	-0.353	0.724	-0.241	0.167
SCORERU	0.0006	0.001	1.019	0.309	-0.001	0.002
SCORESU	0.0156	0.002	6.681	0.000	0.011	0.020
AGE	0.0009	0.004	0.201	0.840	-0.008	0.009
RAWPU	0.0048	0.001	4.052	0.000	0.002	0.007
RAWSU	-0.0148	0.003	-4.780	0.000	-0.021	-0.009
SEXBINARY	-0.0833	0.045	-1.872	0.062	-0.171	0.004

Logistics Regression Estimated Coefficients

Param: C=100
Coefficients Train
[[0.10021598 **0.25542059** -3.01614361]]
[-14.53006186]
Coefficients Test
[[0.15628008 **0.26641391** -2.34340151]]
[-18.32621031]

Accuracy of PASS status
RESULTBINARY 0 1
row_0
0 62 1
1 4 69

Percentage accuracy
0.9520295202952029

Percentage accuracy
0.9632352941176471
array([1. , 1. , 1. , 0.92592593, 0.92592593])

Lasso Regression

R^2 for the model with training model:
0.556988792612555

Parameter estimates for the model with few features:
[0.00746823 **0.01078327** -0. -0.28125652]

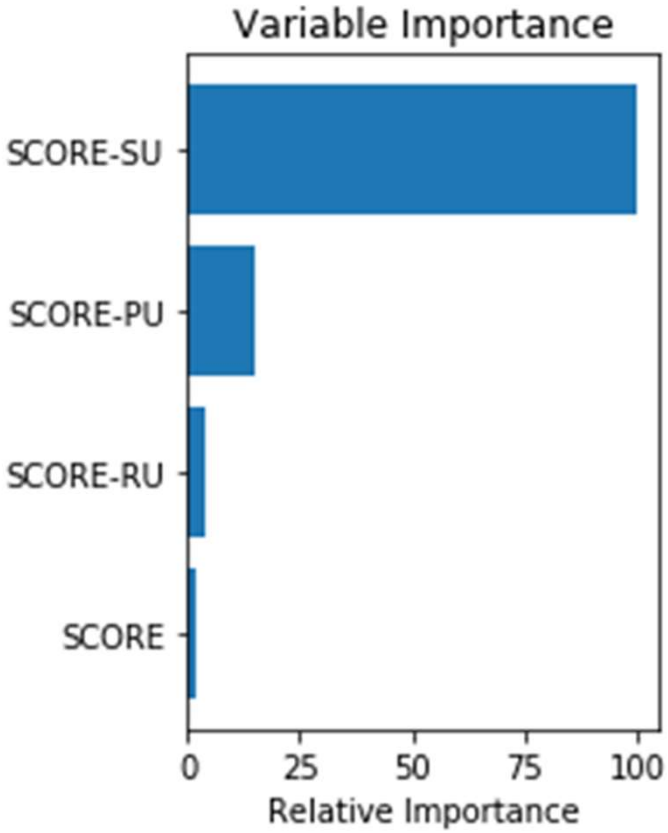
R^2 for the test model:
0.601118484215785 4

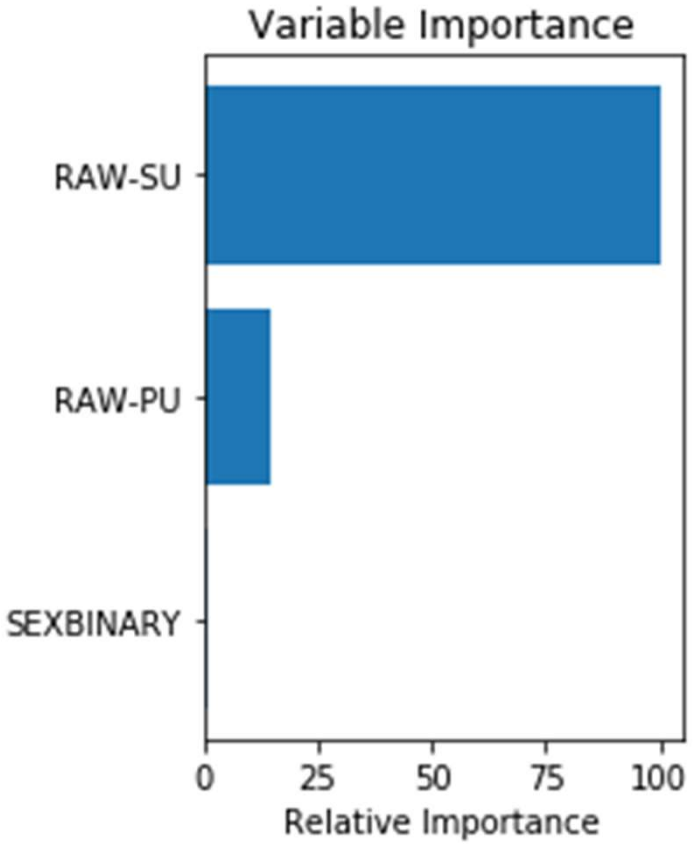
Parameter estimates for the model with many features:
[0.00422301 **0.01332148** -0. -0.25294152]

Models which were not optimal

- Linear Regression
  - Dependent variable is categorical
  - Lack of Linear Relationship
- Decision Tree
  - High R^2: .988
- Random Forest
  - Did not reduce R^2
  - High R^2: .963

Variable of Importance





Limitations

- Lack of data for costs of Soldiers who are on profile
  - The dependent variable was converted to binary
- Not enough female Soldiers to accurately make a determination
  - Due to the class imbalance between Pass and Fail(to include Profile) down sampling was utilized.
  - Down sampling gender would not have been accurate due to the lack in size of the female populations
- There are limitations to utilizing real data sets
  - Cleaning data is difficult
  - Attempting to extract insights that may not exist

Recommendations

- Failures of the initial APFT should be put into a separate Basic Training Company.
- Failures should work more on their Sit-ups to prevent injury as well as improve their overall score.

Questions?