((CENTRIC))

Predictive Analytics World

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Improving Employee Utilization with Machine Learning

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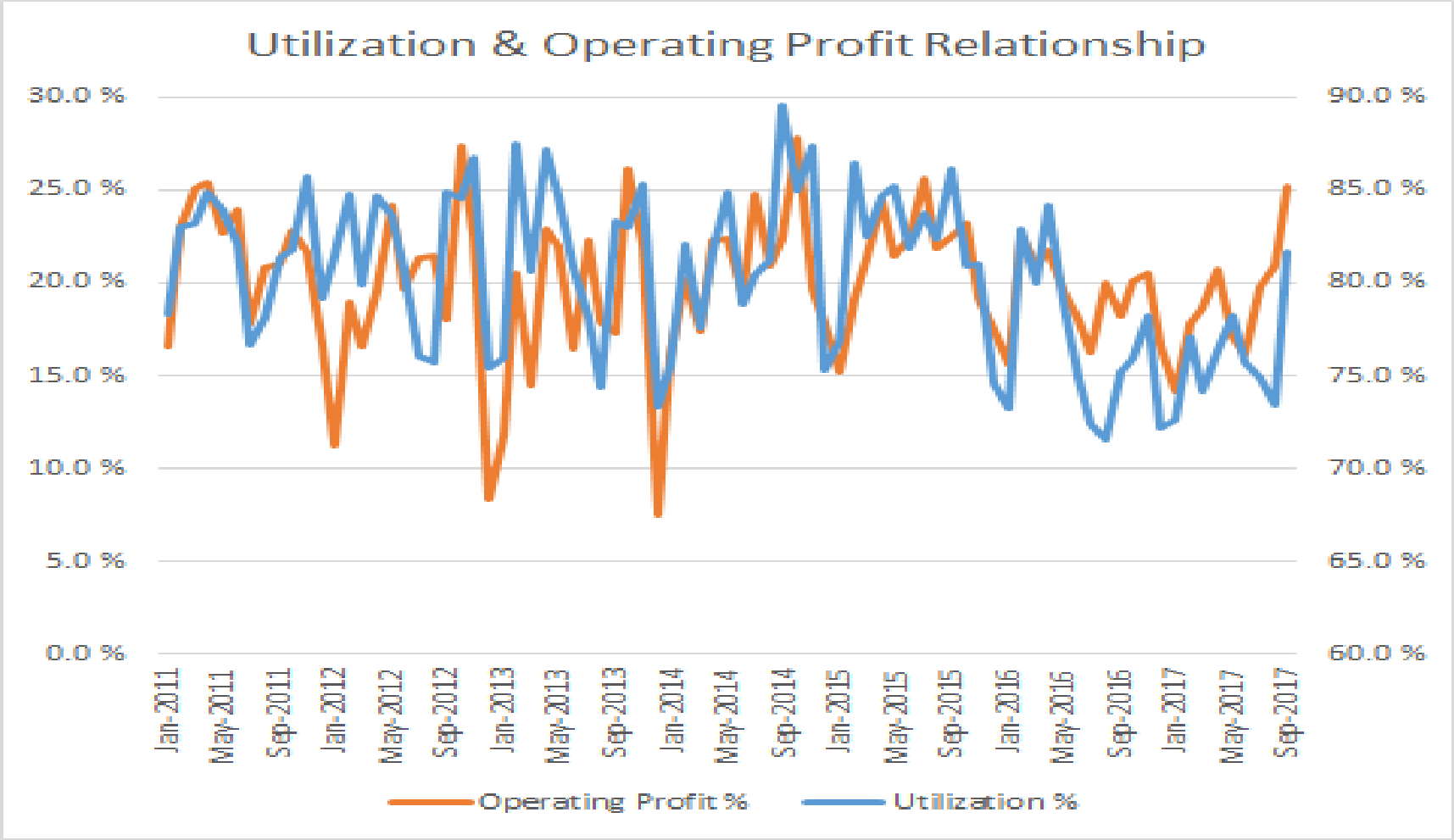
What is Utilization?

- Professional Services firms derive revenue from “billable hours” worked by their consultants and charged to their clients
- When consultants aren’t billing they are a sunk cost
- Utilization is the ratio of billed hours to all hours worked
- Staffing is the process of matching the right person to the right project at the right time to optimize utilization

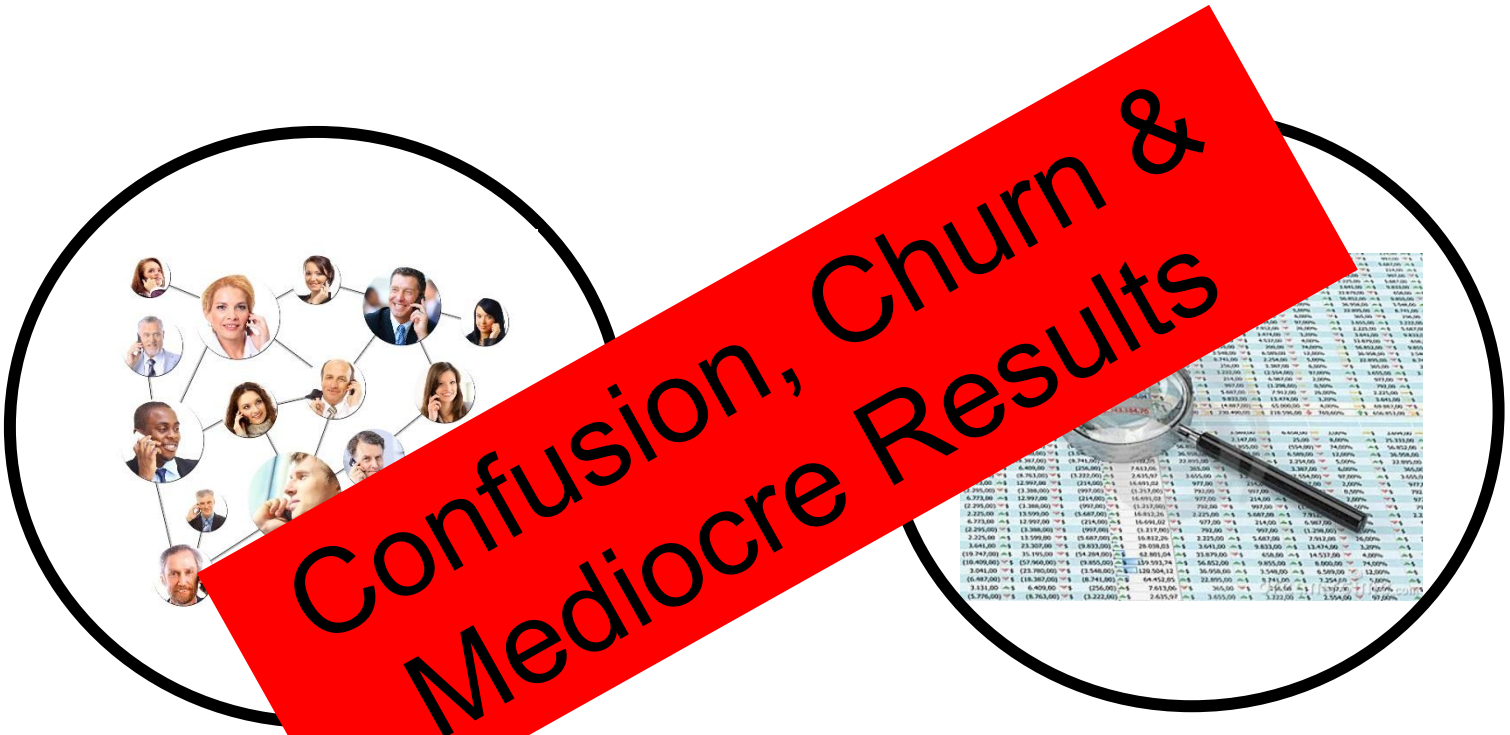
Utilization Drives Profitability



Utilization Drives Employee Satisfaction

- Employees don't like to be "on the bench" for a long period of time – Consultants like to be busy!
- Average utilization of departed employees = 67.3%
- Average utilization of current employees = 76.3%

How We Used To Staff

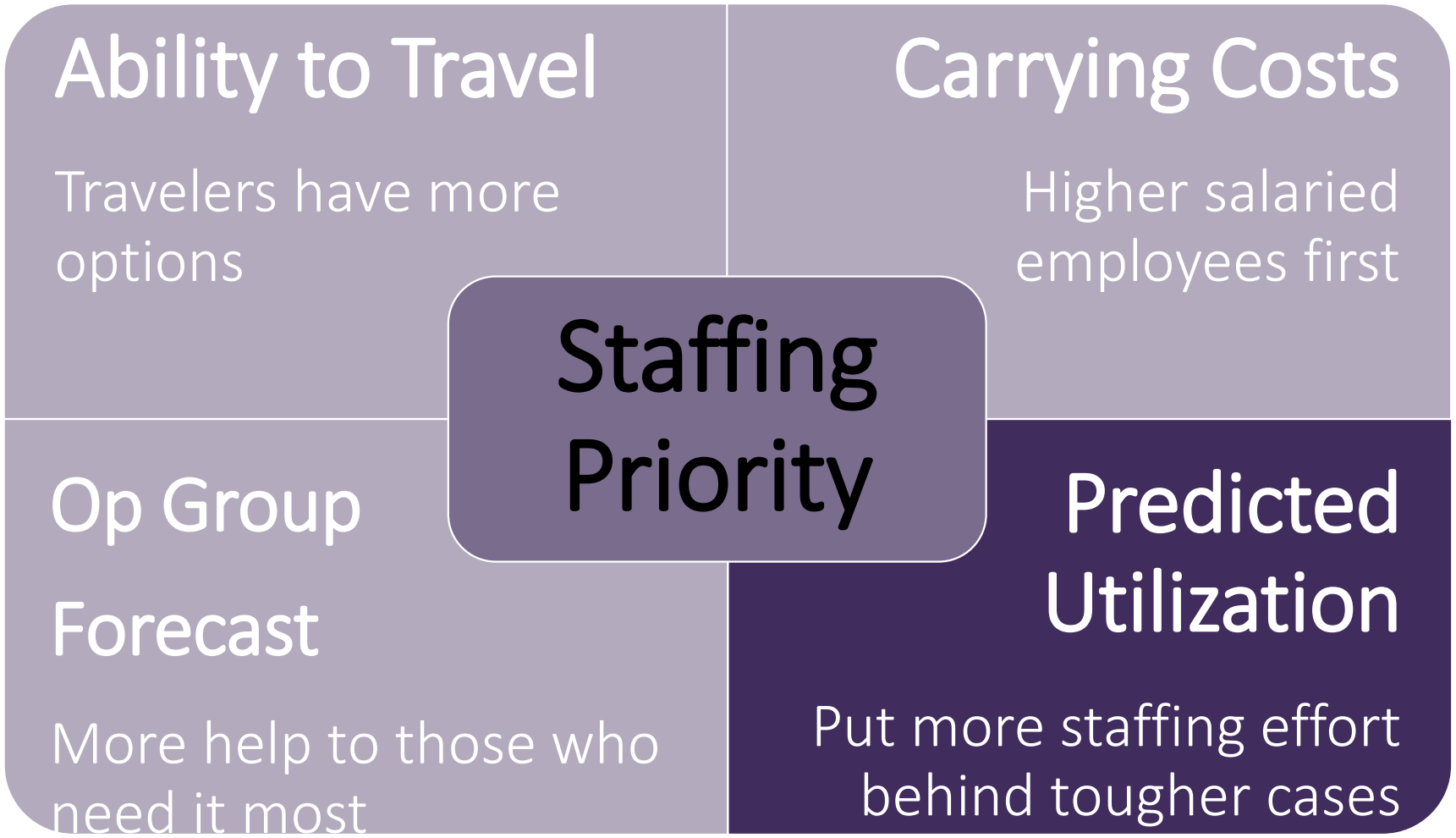


Massive Round Robin Conference Call

Massive Spreadsheet

THERE HAS TO BE A BETTER WAY!!!

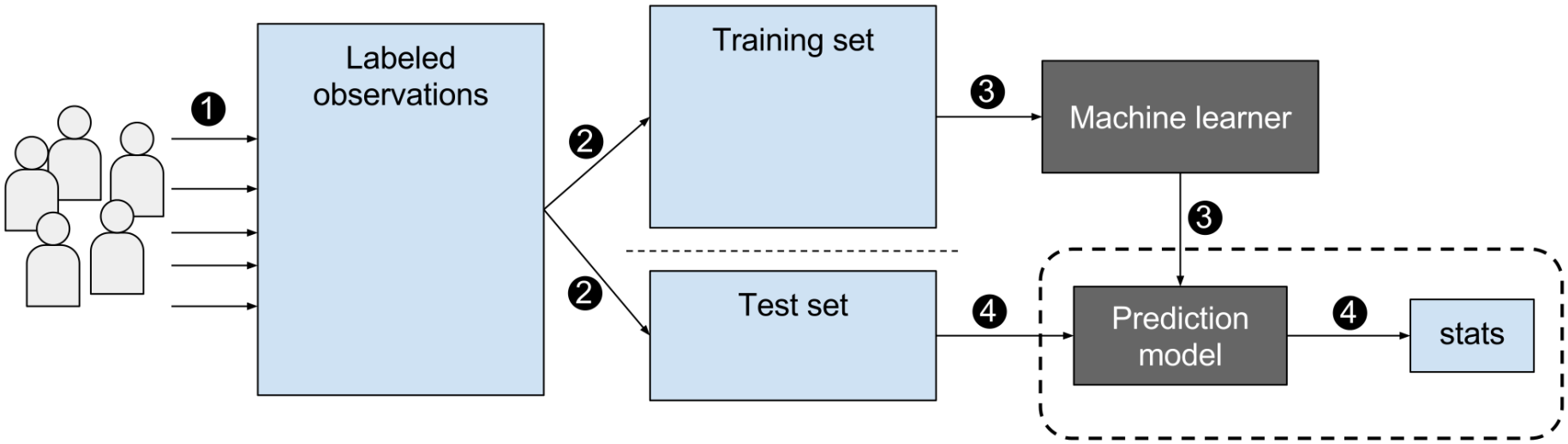
Voila… The Prioritization Algorithm



Prioritization Algorithm

Rank	Name	BU	Travel	Job Title	Predicted Utilization	BU Rank	Travel Rank	Job Title Rank	Util Rank	Score
1	Charles Wales	EAS	51 - 75%	Senior Manager	Low	4	4	4	4	16
2	William Cambridge	EAS	51 - 75%	Senior Manager	Medium-Low	4	4	4	3	15
3	Kate Middleton	Bus Cons	> 75%	Senior Architect	Medium-High	4	4	4	2	14
4	Harry Cambridge	EAS	51 - 75%	Senior Manager	Medium-High	4	4	4	2	14
5	Megan Markle	Tech SL	26 - 50%	Manager	Low	4	3	3	4	14

Predicted Utilization: Machine Learning



Observations included:

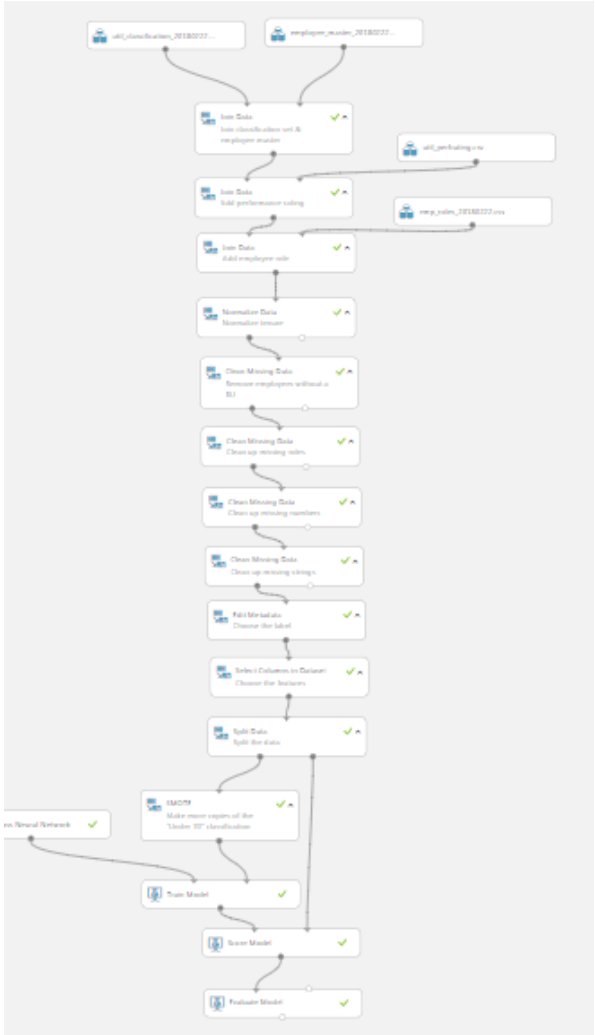
- Past Utilization
- Tenure
- Skills
- Travel Preference
- Job Title
- Performance Review
- Operating Group

Predicted Value:

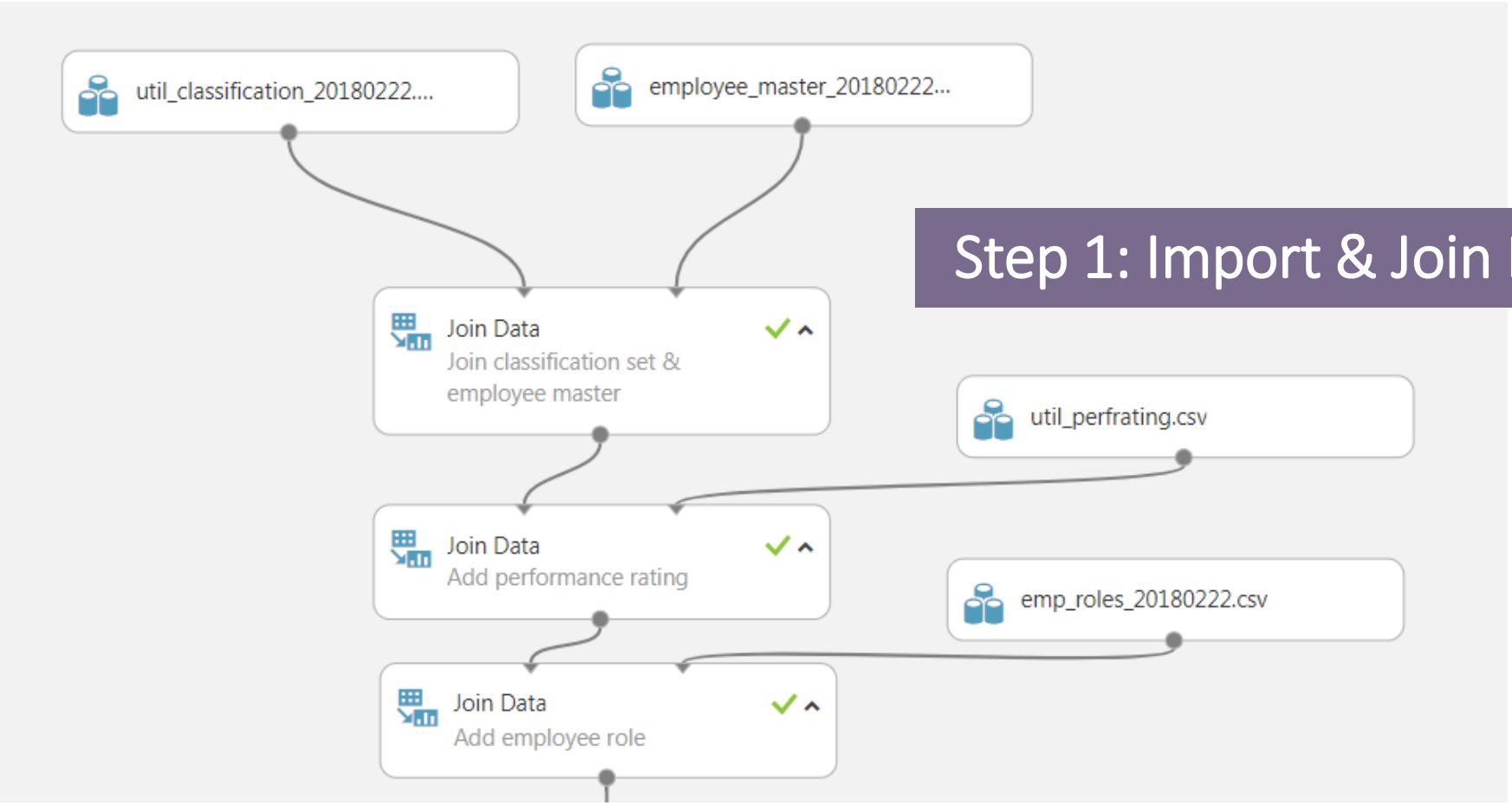
- High Utilization
- Low Utilization

Predicted Utilization: ML Gory Details

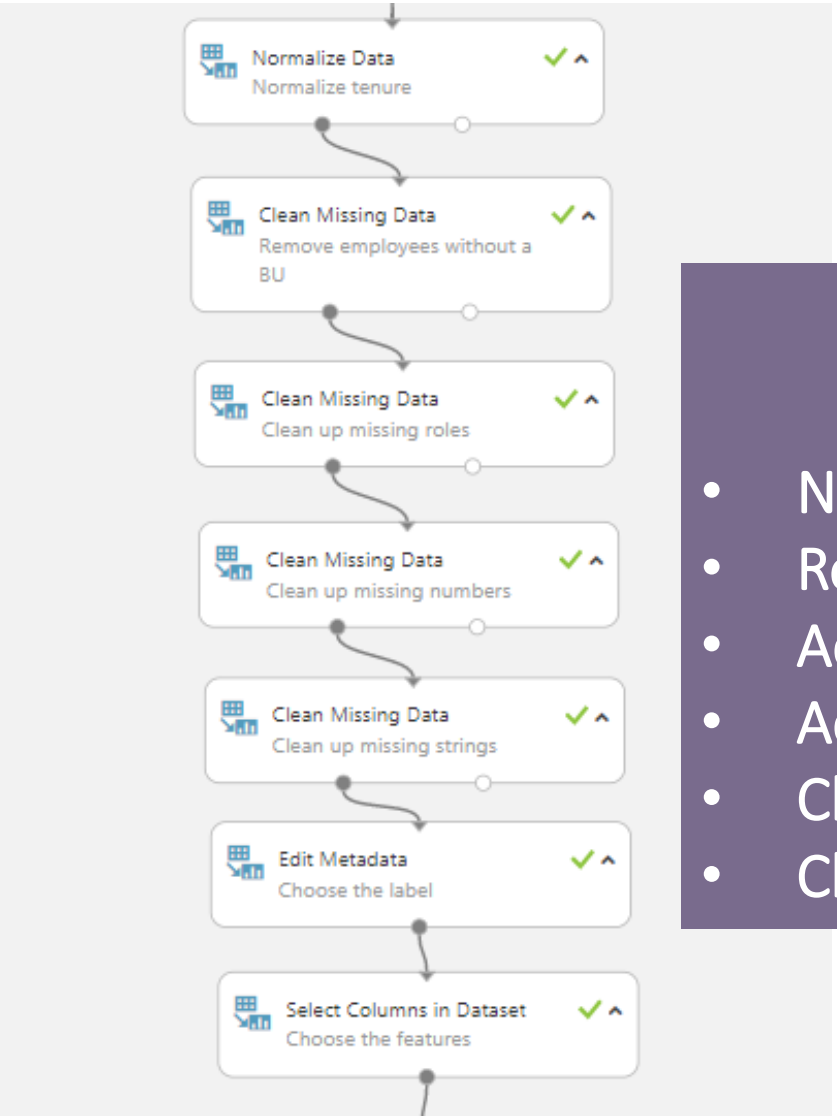
- Tool: Azure Machine Learning Studio
- Two-class Classification
  - Multiclass gave shaky results, so we simplified
- Tested multiple algorithms
  - Logistic Regression
  - Decision Jungle
  - SVM
  - ***Neural Network***
  - Boosted Decision Tree
- Train/Test %: 75/25
- Results:
  - AUC = .746
  - Recall = .850



Predicted Utilization: ML Gory Details



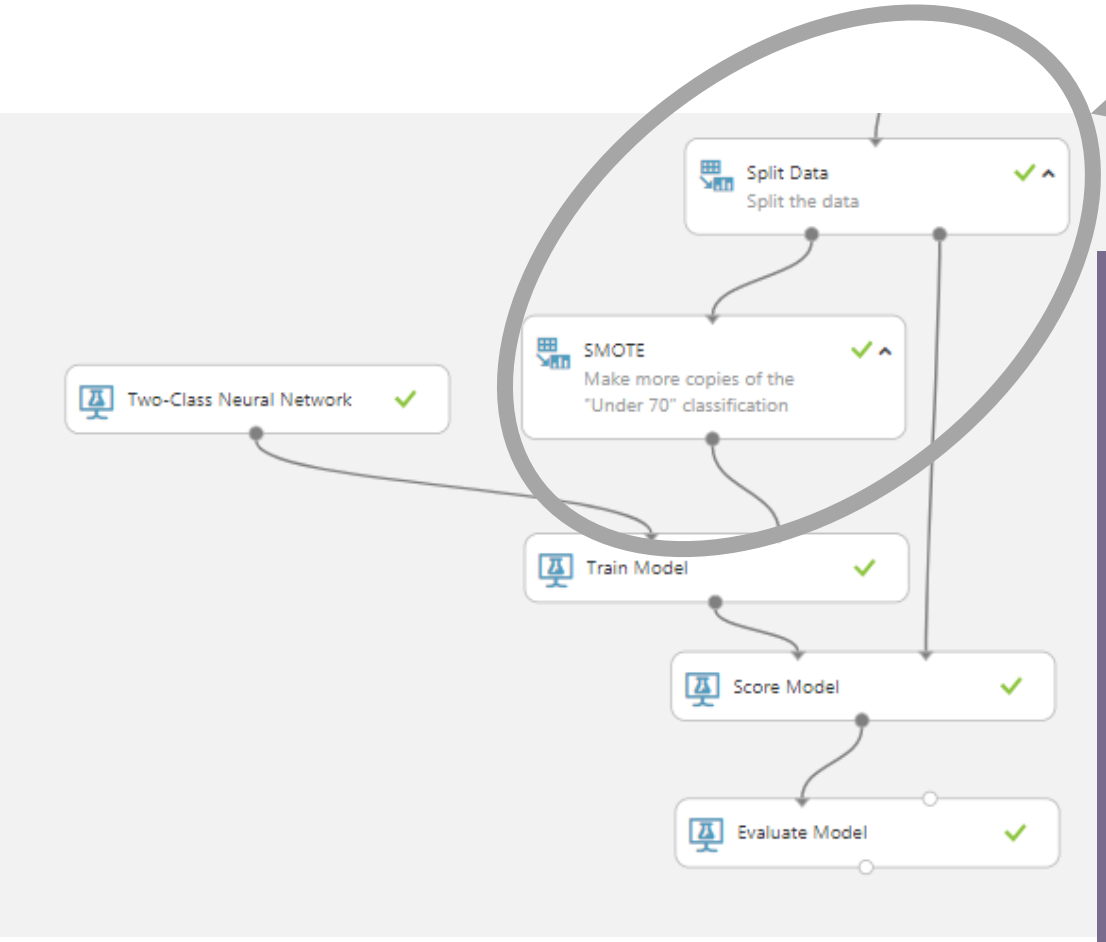
Predicted Utilization: ML Gory Details



Step 2: Prepare Data

- Normalize tenure
- Remove employees w/o an operating group
- Account for missing string values
- Account for missing number values
- Choose label (predicted value)
- Choose features (input data)

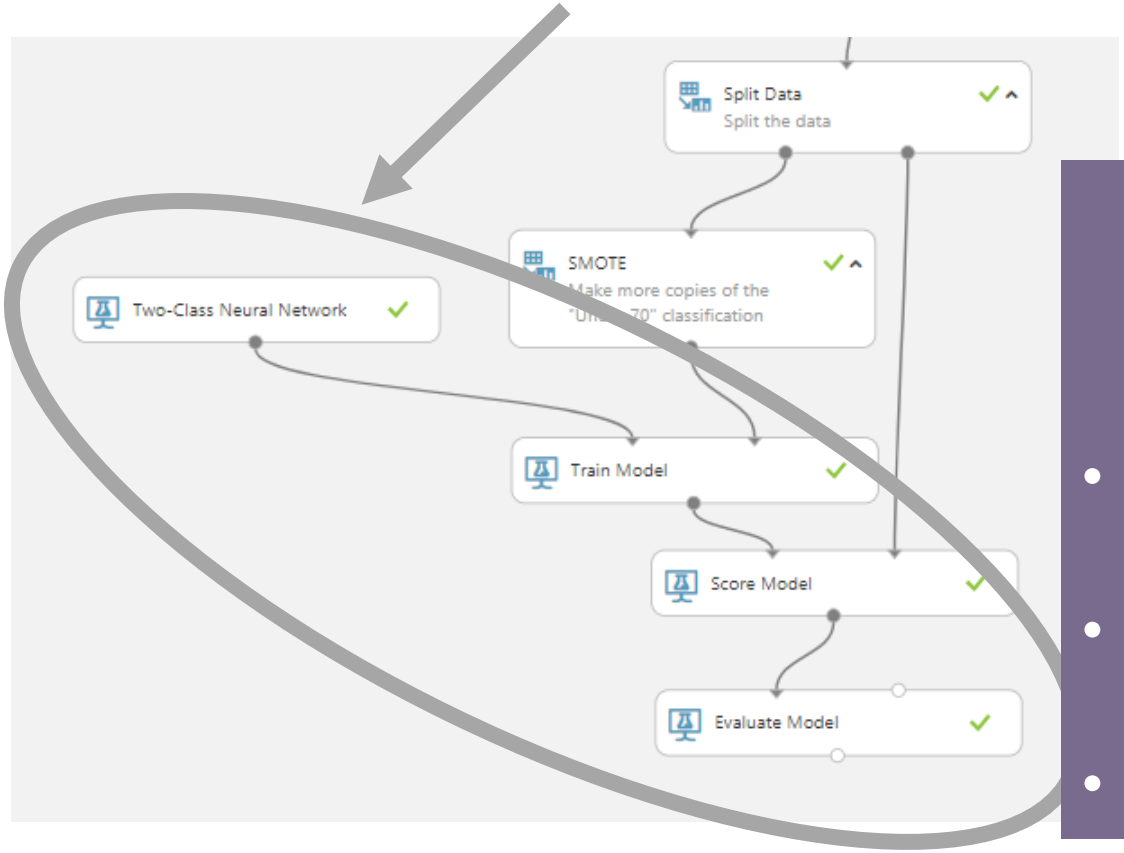
Predicted Utilization: ML Gory Details



Step 3: Create Train/Test Data

- Split 75/25 Train/Test
- SMOTE: To have similar number of positive/negative examples, make extra copies of smaller group

Predicted Utilization: ML Gory Details

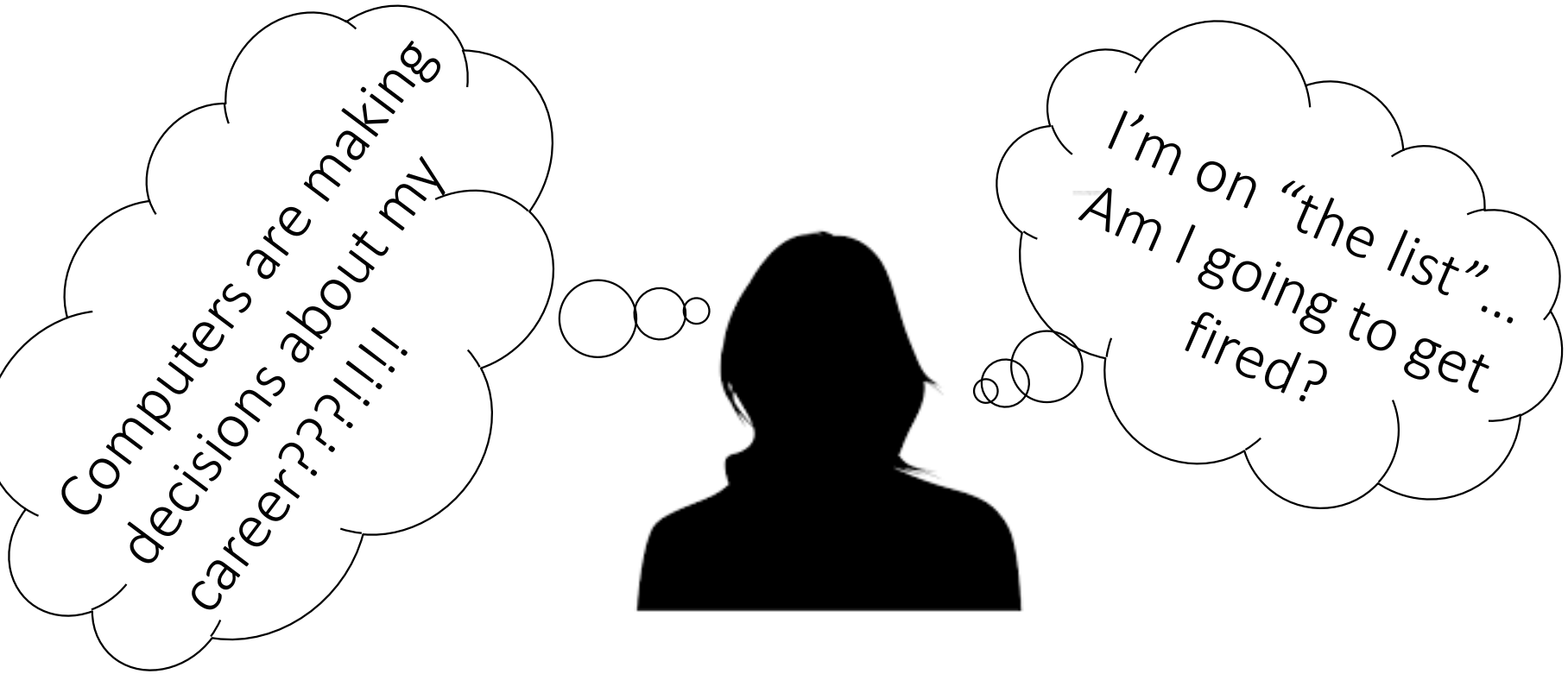


Step 4: Train Model & Evaluate

- Train model w/ choice of algorithm
- Score trained model against test data set
- Evaluate model (statistics)

Machine Learning: The Human Component

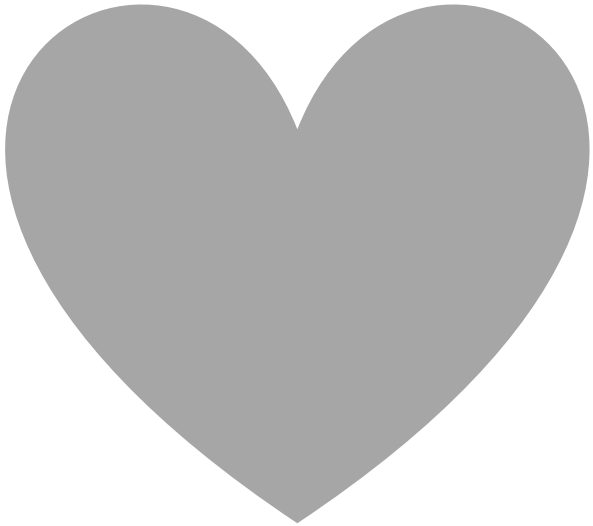
Machine Learning is powerful… and scary!



Machine Learning: The Human Component

Positive not punitive!

- Identify training to build new skills
- Shadow another employee on an existing project
- Pro-actively find projects that fit their background

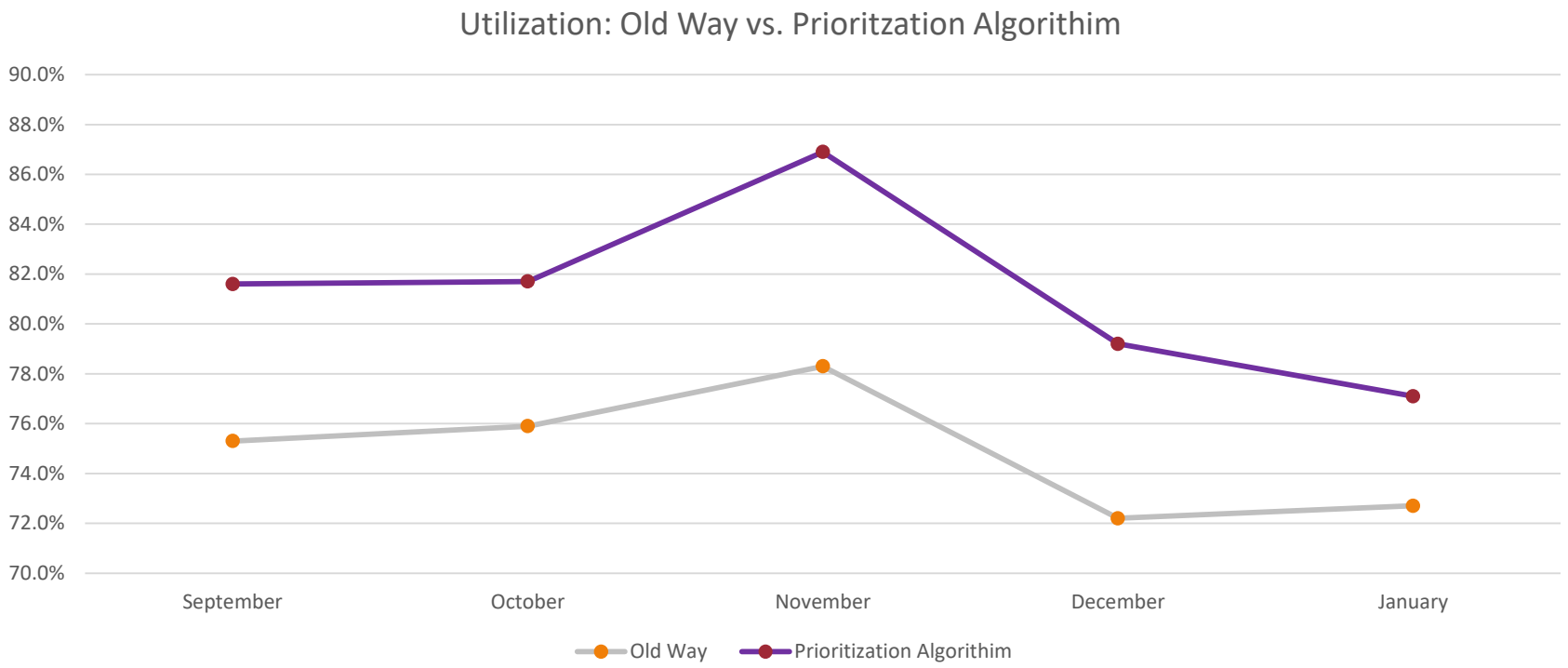


Machine Learning: The Human Component

People aren't spreadsheets!

- Pictures resonant
- Present info in a "approachable" way
- Who is the person beyond the skills?

Improved Utilization with ML



Improved Utilization…

…Improved Profitability (+20%!)

Parting Words of Wisdom

- You can evolve even mundane internal processes with “fancy” machine learning
- Azure Machine Learning Studio is a quick, easy, and cheap way to rapid prototype
- Human considerations are just as important as your algorithm choice