Introduction

**About Yamaha:** Yamaha Precision Propellers is one of the leading investment casting propeller manufacturers in the United States.

**Problem:** The company aims at reducing the amount of product scraped to less than 2%. The successful to defective pour ratio at the start of the project was too high, due to investment casting being a tedious process with multiple variable factors.

**Motivation:** To create a data prediction model that would evaluate the data and predict which factors lead to a failed pour.

**Goal:** To clean the dataset and identify key factors impacting scrap production.

Prediction Model Approach

**MLP Classifier Model:**
- Model based on a neural network that predicts qualitative labels using features that are both qualitative and quantitative features.
- Manipulates the weights toward features to find the best prediction routes.

```
# Example code for MLP Classifier
from sklearn.neural_network import MLPClassifier
mlp = MLPClassifier(hidden_layer_sizes=(10, 10), max_iter=1000)
mlp.fit(X_train, y_train)
```

```
# Example code for prediction
predictions = mlp.predict(X_test)
```

Decision Tree Approach

The most weighted features from running the random forest algorithm are PourComplete, Oven_CNT, TiltTime, PourAngle, PourDelay, PourAreaTemp

```
The number of Nans (no defects predicted) heavily outweighs the number of shrink and non-fill, hence the decision model algorithm struggled to find enough training data points.
```

Findings

- Implemented random forest algorithm multiple times and established permutation importance on the model.

Future Scope

- Use tensor flow to re-create the prediction model
- Identify additional parameters that could be affecting the scrap production
- Provide Yamaha engineering with the tools and training documentation

Conclusion

There was no singular factor that led to a failed pour.

The main processing factors that led to a failed pour are; (Put this in later).

Identifying Operator error has reduced scrap production by ~8%

Acknowledgement and References

- Thank You to the Yamaha Team for their continuous support.
- The creators of all the different data analytics tools that were used.
- The Data Mine team for their guidance.