**Problem Statement:** Predicting provider reliability on RushPro based historical data which may directly impact customer retention, satisfaction and overall credibility of platform.

**Objective:**

* Building a ml model that classifies a provider as reliable (1) or not reliable (0).
* Evaluating the models’ performance.
* Using best models to extract feature importances.
* Model is saved as pickle file and used for predictions.

**Dataset overview:** It consists of total 7 features and total of 200 samplesnut in terms of target label its highly imbalanced as reliable (1) has only 5 entries.

**Pre-processing:**

* provider\_id is dropped as it just an identifier.
* Using Standardscaler normalization of data is done.
* Stratified sampling is done while splitting data into train (80%) and test (20%)
* class\_weights=’balanced’ is applied to each model counter class imbalance.

**Model training and Evaluation:**

* Logistic Regression, Random Forest Classifier and SVM were used for training.
* They were evaluated using Accuracy, Precision, Recall, F1-score on both the classes.
* Confusion matrix.

**Logistic Regression:**

| **Metric** | **Not Reliable(0)** | **Reliable(1)** |
| --- | --- | --- |
| Precision | 1.00 | 0.33 |
| Recall | 0.95 | 1.00 |
| F1-score | 0.97 | 0.50 |
| **Accuracy** | **0.95** |  |

**Outcomes:**

* Confusion matrix show that it correctly identified 37 instances of not reliable and 1 instance of reliable but misclassified 2 instances of not-reliable providers as reliable.
* Recall for class 1 is perfect.
* Precision is low means if more positive samples existed, false positive may increase.
* Overall accuracy is 95%.

**Random Forest Classifier:**

| **Metric** | **Not Reliable(0)** | **Reliable(1)** |
| --- | --- | --- |
| Precision | 0.97 | 0.00 |
| Recall | 1.00 | 0.00 |
| F1-score | 0.99 | 0.00 |
| **Accuracy** | **0.97** |  |

**Outcomes:**

* Confusion matrix shows 39 not reliable are classified accurately but one instance of reliable is misclassified.
* Only good at majority class classification.
* Failed completely on minority class, which makes it unacceptable to be used for predictions.
* Tree based models struggle in case of class imbalances.

**Support Vector Machine (SVM):**

| **Metric** | **Not Reliable(0)** | **Reliable(1)** |
| --- | --- | --- |
| Precision | 1.00 | 0.50 |
| Recall | 0.97 | 1.00 |
| F1-score | 0.99 | 0.67 |
| **Accuracy** | **0.97** |  |

**Outcomes:**

* Confusion matrix shows 38 instances of not reliable classified properly and among 2 instances of reliable 1 is properly classified and another is misclassified as not reliable.
* It has best overall balance between precision and recall on minority class (1).
* Best overall accuracy 97%.
* Ideal for model deployment among all models used.

**Feature importances (in accordance to best model SVM):**

| **Feature** | **Importance** | **Interpretation** |
| --- | --- | --- |
| **complaints** | 0.30 | Having most importance. More complaints make it less reliable. Low complaints improves score and makes most impact. |
| **on\_time\_percent** | 0.28 | Makes second to complaints but holds great importance in determination reliability. If jobs are finished on it makes a major positive impact on reliability. |
| **job\_completion\_rate** | 0.25 | It is also crucial as others with very less difference to other. If jobs are abandoned or skipped it will bring down chances to be reliable. |
| **average\_rating** | 0.16 | Have lesser impact. Having higher ratings may help, but not as much as the complaints, timing and completion rate. |
| **cancellations** | 0.01 | Have a minuscular effect. Jobs cancelled do not change have any major impact on reliability scores. |

**Conclusion:**

The SVM is most effective under a such dataset which is highly imbalanced, usage of stratify and class\_weights=’balanced’ makes model shows at least a balanced outcome while involving instances from both classes. Also, in order to get best results, we may have to balance the set or generate a synthetic data using augmentation techniques to get more appropriate and balanced results which works equally good on both classes. But still SVM model predicts good on both classes when saved and loaded as a pickle file it was able to predict both reliable and unreliable class.