Insights

Decision Tree and Random Forest Selection Justification

Overview:

When selecting models for prediction, it's essential to evaluate their performance based on various metrics such as **Accuracy**, **Precision**, **Recall**, and **F1 Score**. Both **Decision Tree** and **Random Forest** have demonstrated strong performance across all these metrics, making them ideal candidates for our application. Here's why these models were chosen:

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1. Accuracy:

- **Random Forest** and **Decision Tree** achieved the **highest accuracy (83.7%)** among all the models, indicating that they correctly predicted the outcomes for a significant proportion of cases.

- Accuracy alone, however, may not capture the full performance, so other metrics are also considered.

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2. Precision:

- **Decision Tree (0.8418)** outperformed Random Forest (0.8370) and other models in terms of precision.

- High precision indicates that when the model predicts a positive class, it is highly likely to be correct. This is particularly useful in applications where false positives can have significant consequences.

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3. Recall:

- Both **Decision Tree** and **Random Forest** achieved a **recall of 0.8370**, meaning they were equally effective at identifying true positives from the dataset.

- High recall ensures that the model does not miss significant cases (true positives), which is vital for applications like medical diagnoses or risk assessments.

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4. F1 Score:

- **Decision Tree (0.8319)** slightly outperformed Random Forest (0.8370) in F1 Score, which is the harmonic mean of precision and recall.

- The high F1 scores of both models indicate a balanced trade-off between precision and recall, making them suitable for scenarios requiring robust predictions.

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5. Random Forest's Strength:

- **Random Forest** is an ensemble model that aggregates predictions from multiple decision trees, providing better generalization and reducing the risk of overfitting compared to a standalone Decision Tree.

6. Decision Tree's Simplicity:

- **Decision Tree** models are interpretable and easy to visualize, providing insights into the decision-making process. This is particularly useful when explaining results to non-technical stakeholders.

Why Use Both Models?

By combining the strengths of **Decision Tree** and **Random Forest**, the solution can:

1. Leverage the interpretability of Decision Trees for better insights into the predictions.

2. Utilize the robustness and generalization capabilities of Random Forest to minimize overfitting and improve prediction reliability.

This dual-model approach ensures a well-rounded and reliable prediction system, leveraging the individual strengths of each model to compensate for the other's limitations.