Early Detection of Chronic Kidney Disease Using AI in Precision Medicine

Presented by **Team DECODE**

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Topics

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- Previous vs Current Approach
- Workflow of the Project
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- Feature Selection using Random Forest Classifier
- Data Modelling using Cross Validation
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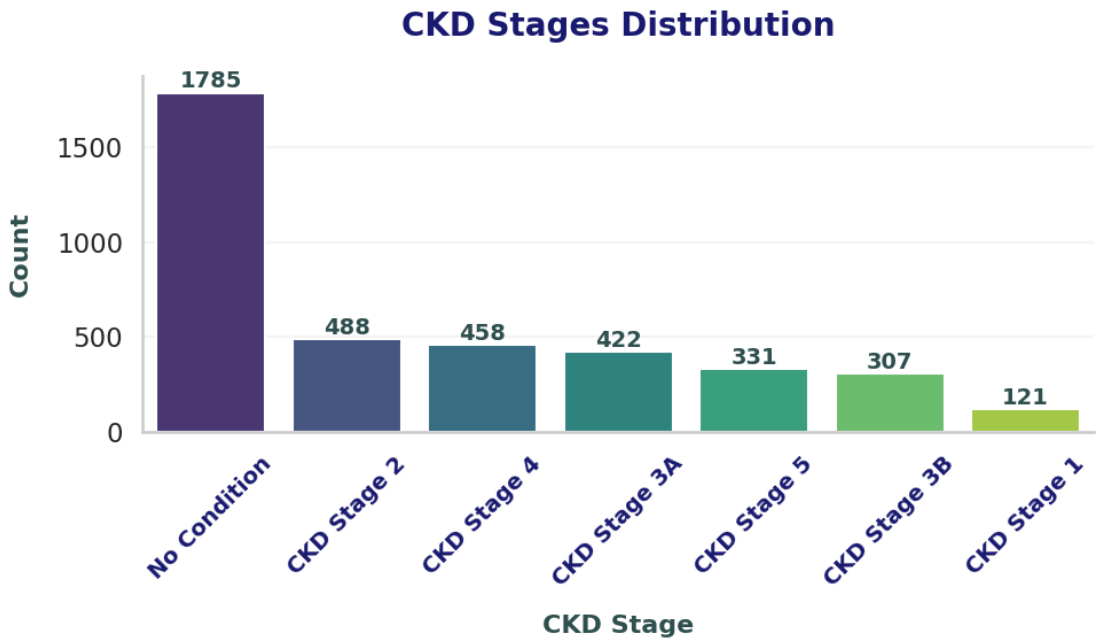
- End Result & Conclusion

Problem Statement

Chronic Kidney Disease (CKD) is often detected too late, when significant kidney damage has already occurred. Traditional screening methods focus on a few markers (like creatinine) and may miss early-stage disease. By using AI to analyze multiple health indicators, we can detect CKD sooner, enabling earlier treatment and better patient outcomes.

Introduction to Chronic Kidney Disease (CKD)

- CKD is a progressive condition where kidneys lose their ability to filter waste and fluids.
- Often Asymptomatic in early stages, leading to late diagnosis.



Previous vs Current Approach

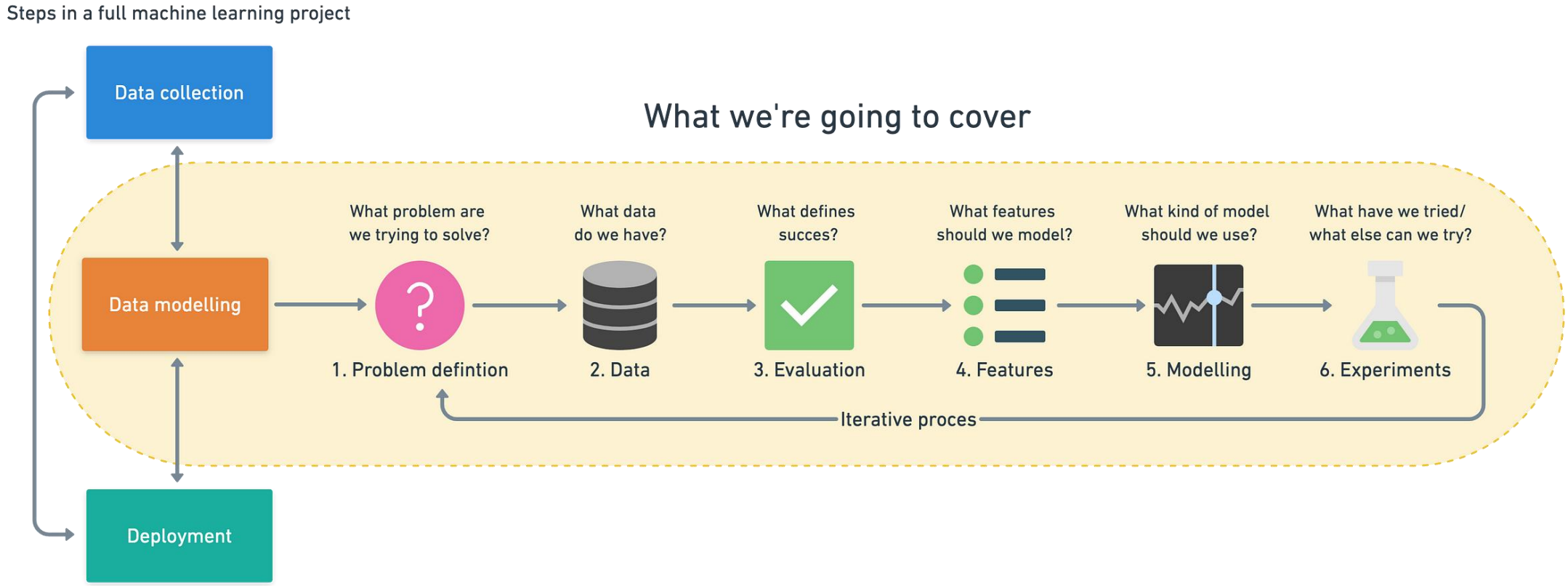
Previous Approach:

- Used 23 features for CKD prediction.
- Achieved 84% accuracy with two models: Random Forest and Logistic Regression.
- Binary Classification (CKD and No CKD)

Current Approach:

- Optimized to 10 features while improving prediction accuracy.
- Achieved 93% accuracy using 8 different models.
- Multi-class classification of different stages of CKD.

Workflow of the Project



Dataset Preparation – All of Us

Demographics

- Age
- Gender

Conditions

- Anemia
- Chronic Kidney Disease Risk
- Coronary Artery Disease
- Diabetes Mellitus
- Hypertension
- Edema of foot

Initial Dataset - (463,087, 23) ~ 463K Rows

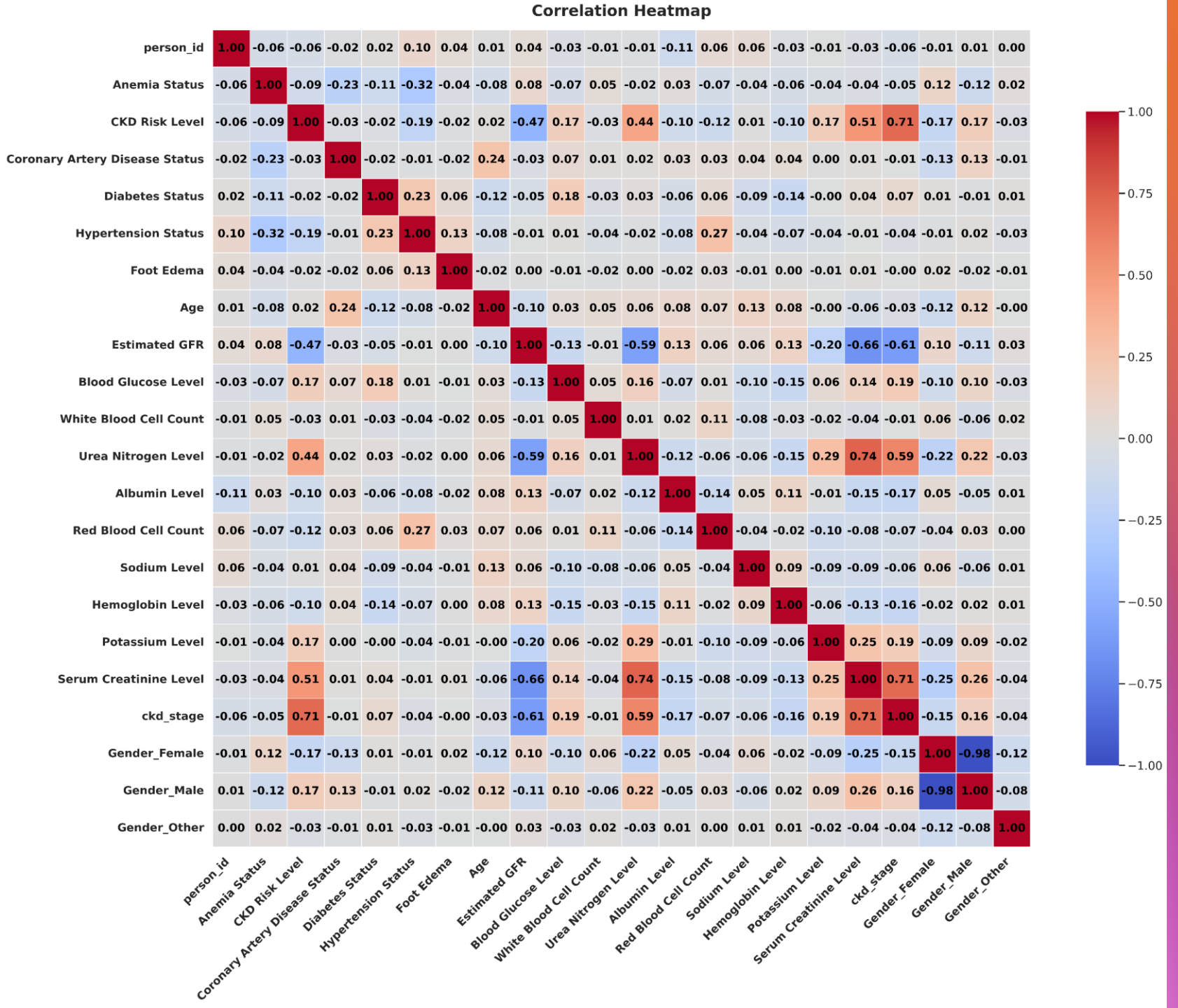
Final Dataset - (3936, 10) ~ 4K Rows

Labs & Measurements

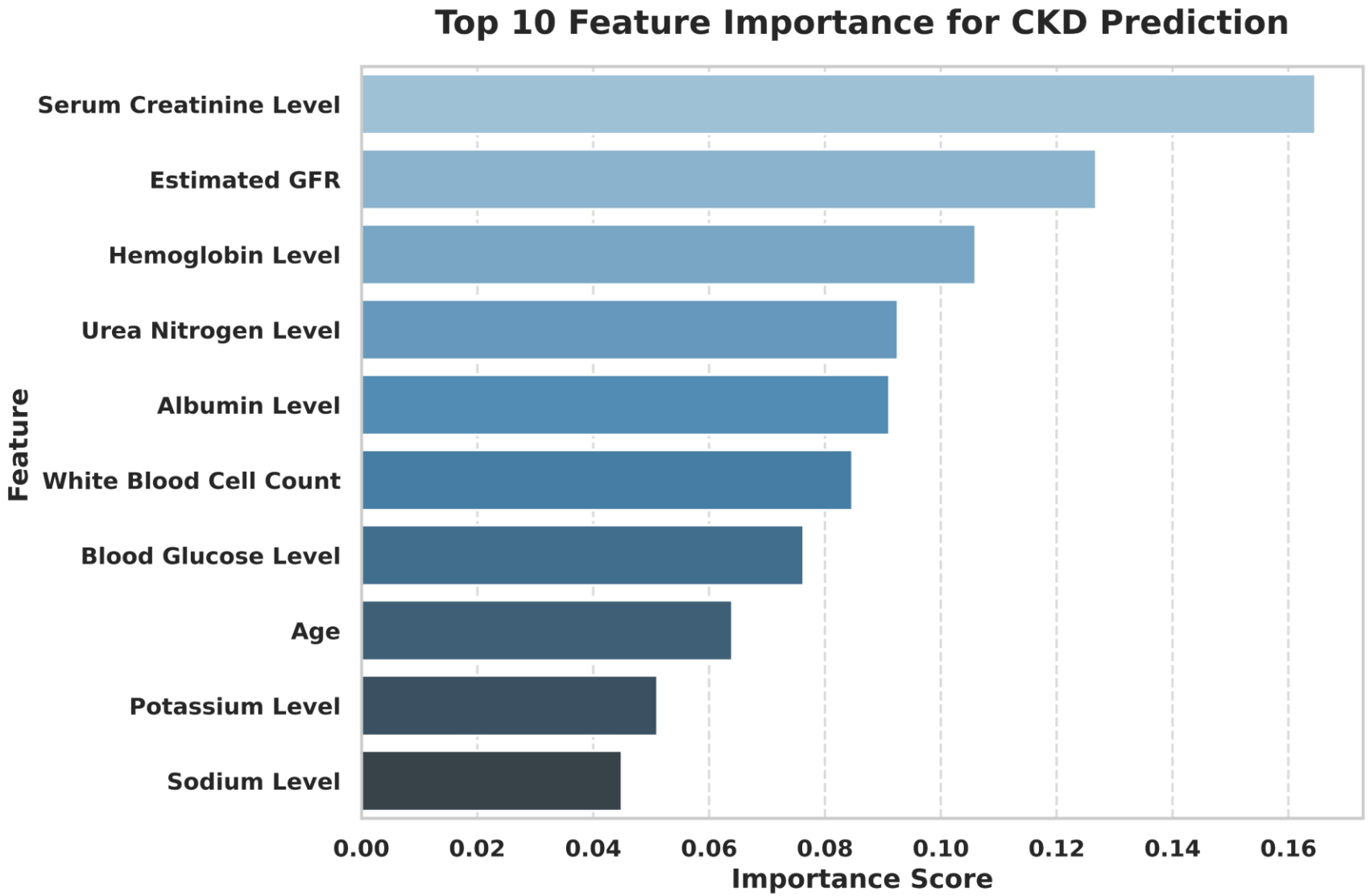
- Blood Glucose
- White Blood Cells Count
- Urea Nitrogen
- Serum Creatinine
- Diastolic Blood Pressure
- Haemoglobin
- Potassium
- Albumin
- Bacteria
- Red Blood Cells
- Sodium
- Specific gravity
- eGFR

Correlation of the features

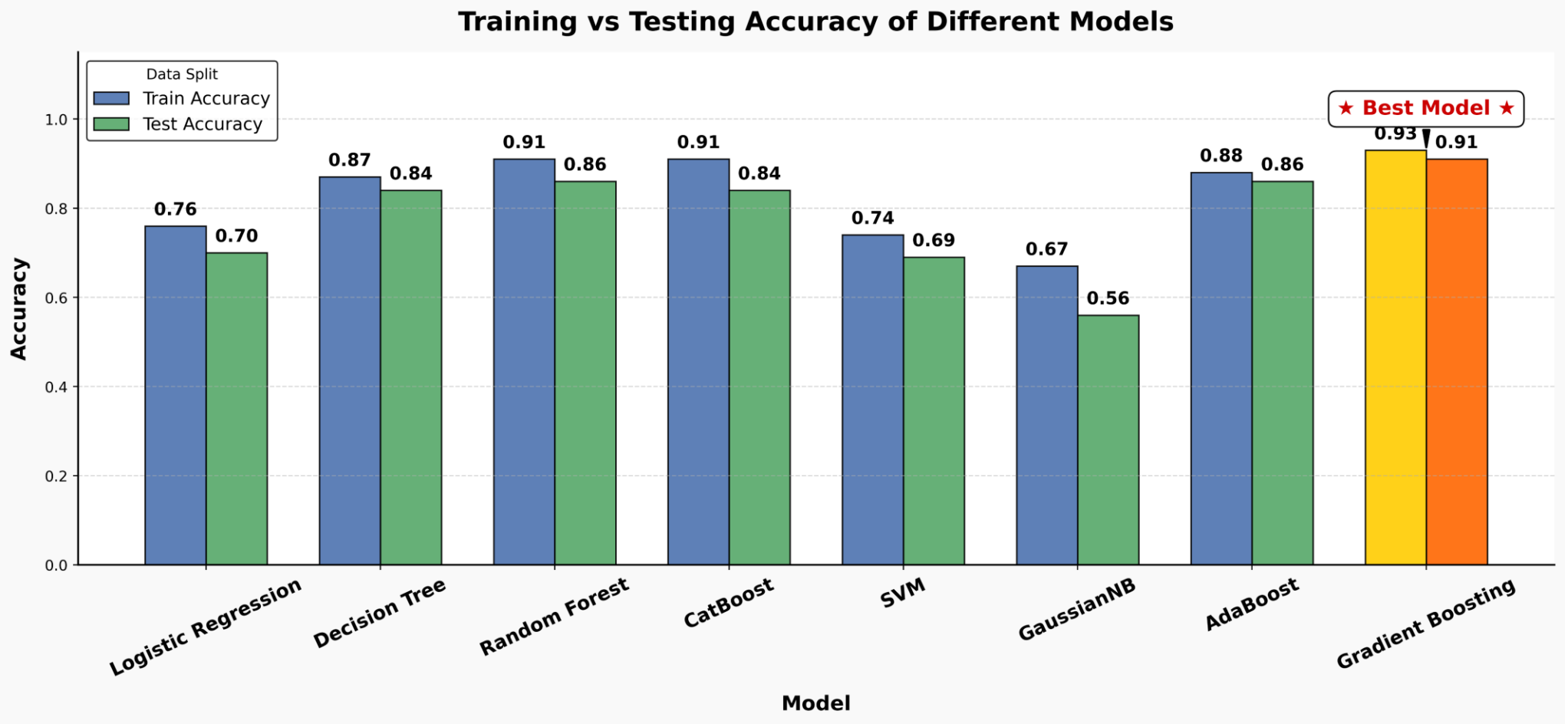
- **Positive correlation** between CKD Stage and Serum Creatinine Level.
- **Negative correlation** between CKD Stage and eGFR.



Feature Selection using Random Forest Classifier.

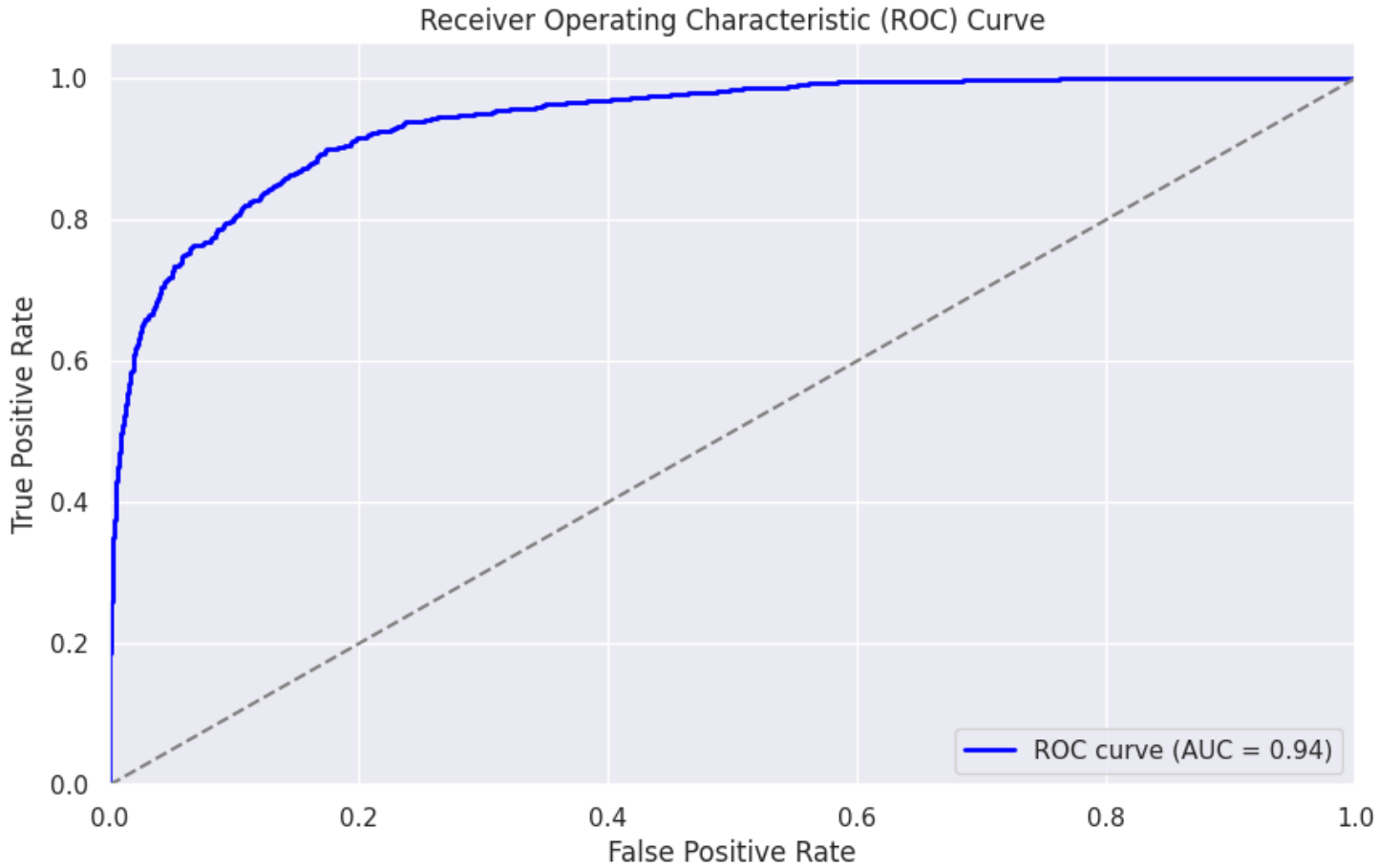


Data Modelling using Cross Validation



Why Gradient Boosting is the best of all?

- Precision: 93%
- Recall: 90%
- F1 Score: 91%
- ROC-AUC: 94%



End Result & Conclusion

✅ **Prediction Stage:** Identifies CKD risk.
✅ **Risk Level:** Low | Moderate | High.
✅ **Prediction Probability:** Model confidence score.
✅ **Actions Needed:** Further tests | Lifestyle changes.

Deployed frontend Application:
https://ckdprecisionmed.vercel.app/

Conclusion: Early detection can change lives. With AI, we can catch CKD sooner, giving patients a better chance at timely care and improved health outcomes. Our model brings us one step closer to a future where technology empowers healthcare.

Open to questions.