**Project Development Phase**

**Model Performance Test**

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| Date | 10 February 2025 |
| Team ID | LTVIP2025TMID38625 |
| Project Name | revolutionizing liver care |
| Maximum Marks |  |

**Model Performance Testing:**

### 🔬 **What Is Model Performance Testing in Liver Care?**

It is the process of assessing how accurately and reliably a trained model performs on medical data related to liver care. This is critical before deploying it in clinical settings or digital health apps.

### 🧪 **Key Evaluation Metrics**

1. **Accuracy**: How often the model makes the correct prediction.
   * E.g., Correctly predicting liver fibrosis stages.
2. **Precision & Recall**:
   * **Precision**: How many predicted positives were correct?
   * **Recall (Sensitivity)**: How many actual positives did the model detect?
   * Important for avoiding false negatives in liver disease detection.
3. **F1 Score**: Balance between precision and recall.
4. **AUROC (Area Under ROC Curve)**:
   * Measures how well the model distinguishes between classes (e.g., cirrhosis vs. non-cirrhosis).
5. **Specificity**:
   * Important for distinguishing between liver conditions with similar symptoms.
6. **Mean Squared Error (MSE)** or **MAE**:
   * Used in regression tasks like predicting liver enzyme levels.

### 🧠 **Use Cases in Liver Care**

* **Early Detection** of conditions like NAFLD or liver cancer.
* **Predicting Decompensation** in cirrhosis patients.
* **Recommending Diets** for liver health via personalized meal planning.
* **Monitoring Treatment Response** with lab data and imaging.

📊 Model Performance Testing Table – Liver Care

| **Category** | **Details** |
| --- | --- |
| **Objective** | Evaluate accuracy and reliability of AI/ML models in liver care applications |
| **Data Types Used** | - Electronic Health Records (EHR)- Lab results (ALT, AST, bilirubin)- Imaging (Ultrasound, MRI)- Lifestyle/diet data |
| **Common Use Cases** | - Liver disease diagnosis (NAFLD, Hepatitis)- Stage prediction (Fibrosis, Cirrhosis)- Personalized nutrition recommendations- Risk prediction (e.g., liver failure) |
| **Key Metrics** | - Accuracy- Precision- Recall (Sensitivity)- F1 Score- AUROC- Specificity- MSE / MAE (for regression tasks) |
| **Testing Methods** | - Train/Validation/Test Split- Cross-Validation- External Validation (different hospitals/populations)- Bias/Fairness Analysis |
| **Tools/Frameworks** | - Python (scikit-learn, TensorFlow, PyTorch)- R (caret, mlr)- Jupyter Notebooks, Google Colab- SHAP/LIME for explainability |
| **Challenges** | - Data Imbalance (few positive cases)- Privacy & Ethics in medical data- Interpretability in clinical settings- Generalizability across populations |
| **Next Steps Post-Testing** | - Model refinement if performance is low- Pilot deployment in clinical workflows if validated- Real-time monitoring and re-training |