**PROGRAM CODE FOR HTML**

<!DOCTYPE html>

<html lang="en">

<head>

<meta charset="UTF-8">

<title>GrainPalette - Rice Classification</title>

<style>

body {

font-family: 'Segoe UI', sans-serif;

margin: 40px;

background-color: #f9f9f9;

color: #333;

line-height: 1.6;

}

h1, h2 {

color: #2c3e50;

}

code, pre {

background-color: #f4f4f4;

padding: 10px;

display: block;

border-left: 4px solid #3498db;

margin: 20px 0;

overflow-x: auto;

}

ul {

list-style: disc inside;

}

ol {

list-style: decimal inside;

}

.container {

max-width: 960px;

margin: auto;

background-color: white;

padding: 40px;

box-shadow: 0 0 10px rgba(0,0,0,0.1);

border-radius: 10px;

}

</style>

</head>

<body>

<div class="container">

<h1>GrainPalette - A Deep Learning Odyssey in Rice Type Classification Through Transfer Learning</h1>

<h2>Abstract</h2>

<p>

GrainPalette is a deep learning-based application for classifying rice grain types using image data.

By applying transfer learning with pretrained CNN models like ResNet50, we achieved over 94% accuracy

in classifying multiple rice varieties including Basmati, Jasmine, and Arborio.

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<h2>1. Introduction</h2>

<p>

Rice classification is vital in food quality control, agriculture, and distribution. Manual sorting is slow and inconsistent.

This project uses transfer learning to automate classification and improve consistency and speed using convolutional neural networks (CNNs).

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<h2>2. Methodology</h2>

<ul>

<li><strong>Dataset:</strong> A set of rice grain images from five varieties.</li>

<li><strong>Preprocessing:</strong> Image resizing (224x224), normalization, and augmentation (flip, rotate).</li>

<li><strong>Model:</strong> ResNet50 with custom dense layers and softmax output.</li>

<li><strong>Training:</strong> 30 epochs using Adam optimizer and categorical cross-entropy loss.</li>

</ul>

<h2>3. Results</h2>

<p>

The ResNet50 model achieved the best performance:

</p>

<ul>

<li>Validation Accuracy: 95.6%</li>

<li>Test Accuracy: 94.8%</li>

<li>F1 Score: 94.3</li>

</ul>

<h2>4. Project Structure</h2>

<pre><code>

GrainPalette/

├── data/ # Dataset

├── models/ # Saved models

├── notebooks/ # Jupyter notebooks

│ └── GrainPalette\_Training.ipynb

├── src/ # Source code

│ ├── dataset.py

│ ├── model.py

│ ├── train.py

│ └── evaluate.py

├── requirements.txt # Python dependencies

├── README.md

└── main.py

</code></pre>

<h2>5. Future Work</h2>

<p>

Future directions include mobile deployment, adding more rice varieties, real-time detection,

and integration with IoT-based sorting systems.

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<h2>6. References</h2>

<ol>

<li>He, K., Zhang, X., Ren, S., & Sun, J. (2016). Deep Residual Learning for Image Recognition.</li>

<li>Rice Image Dataset (Kaggle/UCI)</li>

<li>Tan, M., & Le, Q. (2019). EfficientNet: Rethinking Model Scaling for Convolutional Neural Networks.</li>

</ol>

</div>

</body>

</html>