**PROGRAM CODE FOR PYTHON LANGUAGE**

GrainPalette/

├── data/ # Place your rice dataset here

├── models/ # Trained models saved here

├── notebooks/

│ └── GrainPalette\_Training.ipynb # Jupyter notebook (empty)

├── src/

│ ├── dataset.py # Data loading & augmentation

│ ├── model.py # Transfer learning setup

│ ├── train.py # Model training

│ └── evaluate.py # Accuracy & confusion matrix

├── requirements.txt # All dependencies

├── README.md # Project intro

└── main.py # Optional entry point

from tensorflow.keras.applications import ResNet50

from tensorflow.keras.models import Model

from tensorflow.keras.layers import GlobalAveragePooling2D, Dense, Dropout

from tensorflow.keras.optimizers import Adam

def build\_model(input\_shape=(224, 224, 3), num\_classes=5):

base\_model = ResNet50(weights='imagenet', include\_top=False, input\_shape=input\_shape)

for layer in base\_model.layers:

layer.trainable = False

x = base\_model.output

x = GlobalAveragePooling2D()(x)

x = Dense(128, activation='relu')(x)

x = Dropout(0.3)(x)

predictions = Dense(num\_classes, activation='softmax')(x)

model = Model(inputs=base\_model.input, outputs=predictions)

model.compile(optimizer=Adam(1e-4), loss='categorical\_crossentropy', metrics=['accuracy'])

return model

pip install -r requirements.txt

data/

train/

Basmati/

Arborio/

...

val/

Basmati/

Arborio/

...

python src/train.py