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CP 468 – Artificial Intelligence

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Group 12

How to Download, Configure, Train, and Test Pre-Trained Models

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Introduction

This document serves as a guide for downloading, configuring, training, and testing pre-trained models for lung cancer detection from CT images using Google Colab.

Steps Overview:

1. **Setup and Installation**
2. **Data Loading and Preprocessing**
3. **Model Training (Simple CNN, VGG16, ResNet50, InceptionV3)**
4. **Gradio Interface Setup**
5. **Evaluation and Reporting**

Step-by-Step Instructions

1. Setup and Installation

Objective: Ensure all necessary libraries and tools are installed.

Action:

- Open Google Colab.
- Run the setup and installation code to install required libraries such as pydicom, gradio, pillow, tensorflow, matplotlib, cv2, numpy, sklearn, PIL, os, google.colab, and ImageDataGenerator from tensorflow.keras.

2. Data Loading and Preprocessing

Objective: Download the dataset, connect Google Drive to Colab, and prepare the data.

Action:

1. **Download the Dataset:**
    - Obtain the dataset from Kaggle or Google Drive.
2. **Connect Google Drive to Colab:**
    - Mount your Google Drive to access the dataset.
3. **Specify Data Paths:**
    - Define paths for training, validation, and testing data.
4. **Load and Preprocess Data:**
    - Use functions to load file paths and labels.
    - Convert images to RGB format and preprocess for each model type (resnet, inception, vgg).

3. Model Training

Objective: Train each model (Simple CNN, VGG16, ResNet50, InceptionV3).

Simple CNN

- **Data Augmentation:** Initialize with various transformations such as rotation, width/height shift, shear, zoom, horizontal/vertical flip, brightness variation, and fill mode.
- **Create Data Generators:** For training and validation.
- **Model Definition and Training:** Define a Sequential model with Conv2D, MaxPooling2D, Flatten, Dense, and Dropout layers. Compile and train the model with Adam optimizer, sparse categorical cross-entropy loss, and accuracy metrics.

VGG16

- **Data Generators:** Create for training and validation.
- **Model Definition and Training:** Use VGG16 as the base model, freeze it, add custom layers on top, compile with Adam optimizer, sparse categorical cross-entropy loss, and accuracy metrics. Train the model with early stopping.

ResNet50

- **Data Generators:** Create for training and validation.
- **Model Definition and Training:** Use ResNet50 as the base model, freeze it, add custom layers on top, compile with Adam optimizer, sparse categorical cross-entropy loss, and accuracy metrics. Train the model with early stopping.

InceptionV3

- **Data Generators:** Create for training and validation.
- **Model Definition and Training:** Use InceptionV3 as the base model, freeze it, add custom layers on top, compile with Adam optimizer, sparse categorical cross-entropy loss, and accuracy metrics. Train the model with early stopping.

4. Gradio Interface Setup

Objective: Set up a user-friendly interface for model predictions.

Action:

- Implement a Gradio interface that allows users to upload JPG or PNG files, processes the image using the ensemble of pre-trained models (VGG16, ResNet50, InceptionV3), and displays the predicted class and image preview.
- Customize the interface with a dark theme and project information.

5. Evaluation and Reporting

Objective: Evaluate the performance of each model and the ensemble.

Action:

- Implement evaluation functions to calculate test loss and accuracy, generate confusion matrices, and classification reports.
- Plot ROC curves for each class.
- Evaluate the Simple CNN, VGG16, ResNet50, InceptionV3, and the ensemble model using the test dataset.
- Display evaluation metrics and ROC curves.

Summary

1. **Setup and Installation:** Install required libraries.
2. **Data Loading and Preprocessing:** Download dataset, connect Google Drive, and preprocess data.
3. **Model Training:** Train Simple CNN, VGG16, ResNet50, and InceptionV3 models.
4. **Gradio Interface Setup:** Implement a user-friendly interface for predictions.
5. **Evaluation and Reporting:** Evaluate models and ensemble performance using test data.