Artificial Intelligence – Week 13 (XAI)

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Course Repository:
https://github.com/kaopanboonyuen/SC310005_ArtificialIntelligence_2025s1

🎯 Objective

This week, you will explore **Explainable AI (XAI)** using the **ISIC Skin Cancer dataset**. Your goal is to build an AI model that classifies skin lesion images into **9 classes** and uses **Grad-CAM** 🌈 to explain why the AI predicts a particular class for each image. You will gain hands-on experience in interpreting model decisions and visualizing important regions in images that influence predictions. 🖼️

Dataset Download:
https://www.kaggle.com/datasets/nodoubttome/skin-cancer9-classesisic/data

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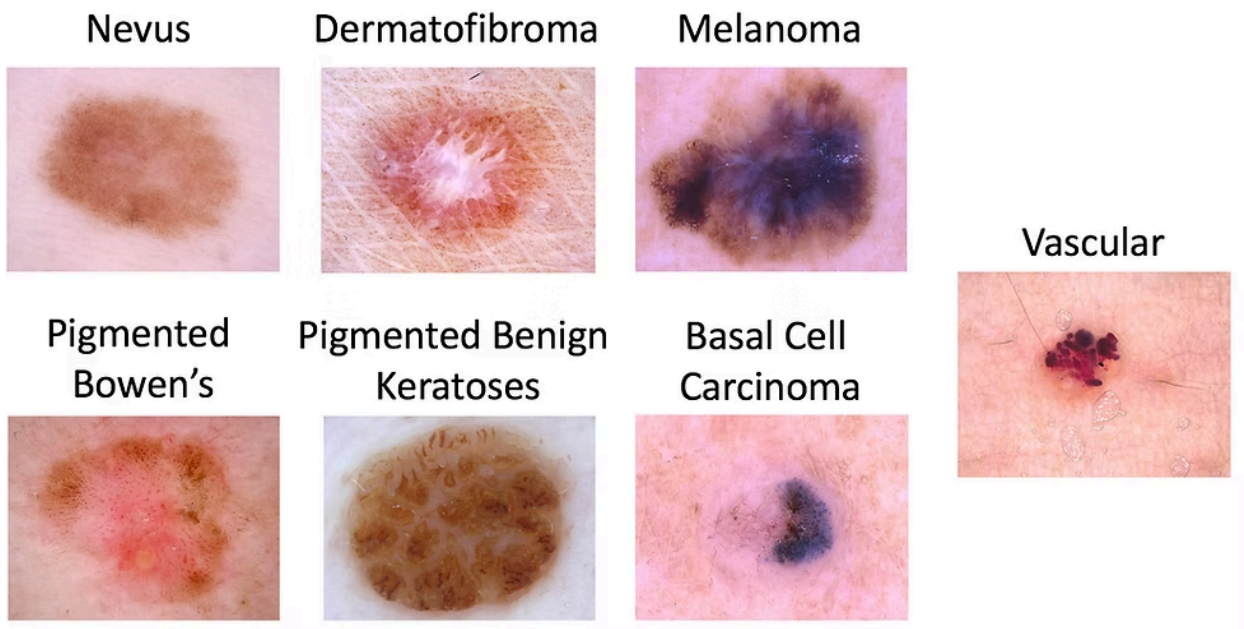


📚 Dataset

Path: Kaggle Skin Cancer Dataset (9 classes)
https://www.kaggle.com/datasets/nodoubttome/skin-cancer9-classesisic/data

Classes:

1. 🟠 actinic keratosis
2. 🟤 basal cell carcinoma
3. 🟣 dermatofibroma
4. 🔴 melanoma
5. ⚪ nevus
6. 🟡 pigmented benign keratosis
7. 🟢 seborrheic keratosis
8. 🔵 squamous cell carcinoma
9. 🟠 vascular lesion

🏗️ Assignment Tasks

1️⃣ Environment Setup

- Load and explore the dataset: number of images per class, image shapes, etc. 📊
- Visualize **5–10 random images per class** 🖼️
- Apply **data augmentation** (e.g., flip, rotation, color jitter) to increase model robustness 🎨

2️⃣ Model Building

- Use a pretrained CNN backbone (e.g., **ResNet50**) for classification 🖥️
- Modify the final layer to output **9 classes** 🔢
- Implement **training** with proper loss (`CrossEntropyLoss`) and optimizer (Adam or similar) ⚙️
- Save and load model weights 💾

3️⃣ Evaluation

- Compute standard metrics:
  - Confusion matrix 📈
  - Classification report with **4-digit precision**
  - ROC-AUC per class 📊
- Visualize these metrics for better understanding 🧐

4️⃣ Explainable AI with Grad-CAM

- Implement **Grad-CAM** 🌈 to visualize which regions of the image influenced the model's prediction.
- Randomly pick **10 images from the test set** and overlay Grad-CAM heatmaps 🔥
- Interpret the results briefly: why the model thinks the image belongs to the predicted class 🤔

5️⃣ Inference / Demo

- Create a simple **Colab inference demo** 💻:
  - Allow the user to upload an image 📤

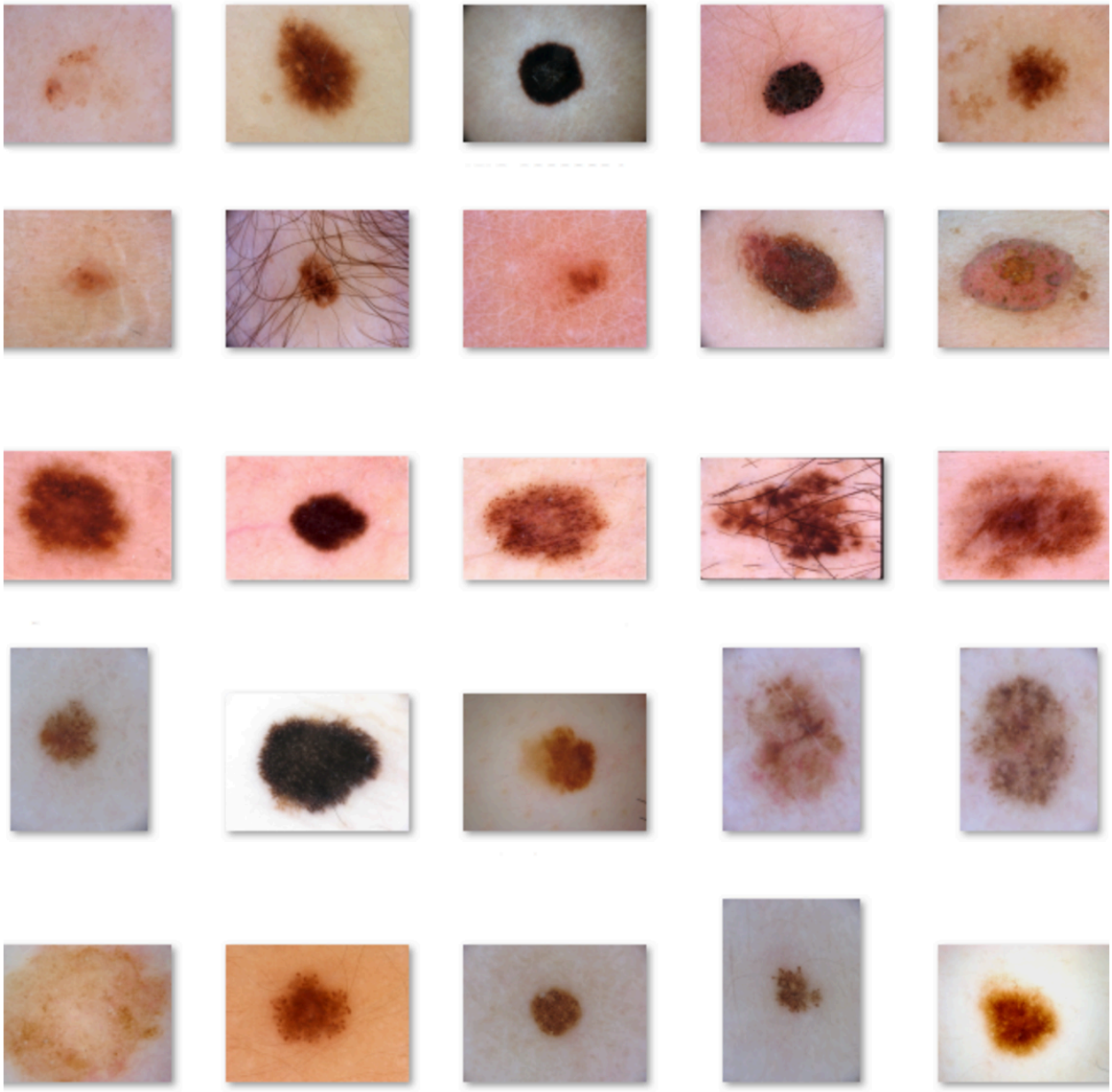
- Run the model to predict the class 🖥️
- Show the Grad-CAM overlay to explain the prediction 🌟

6️⃣ Deliverables

- Colab Notebook including:
  - Dataset exploration and visualization 🖼️
  - Data augmentation pipeline 🎨
  - Model definition, training, and evaluation ⚙️
  - Grad-CAM implementation and visualization 🌈
  - Inference demo with uploaded image 💻
- Extra points for:
  - Detailed analysis of Grad-CAM heatmaps 🔥
  - Comparing predictions with Grad-CAM insights for multiple classes 👀
  - Clear, organized plots and explanations 📝

💡 Tips for Students

- Ensure all images are preprocessed consistently for training and inference 🖼️ Compare model predictions with Grad-CAM regions to see if AI focuses on the lesion 🔍
- Include plots, tables, and concise explanations to make your notebook easy to follow 📊
- Randomness: each run may show slightly different Grad-CAM overlays—highlight this when interpreting results 🔄



Credit Dataset:
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