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| **User Guide** |

**Deep Learning for Lymphoid Malignancies**

Jacinda Garcia

Grand Canyon University

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User Guide: Lymphoid Malignancy Diagnostic Assistant

A deep learning Application for Histopathology Slide Analysis

**Copyright and Legal Information**

Medical Disclaimer: This is project is for research investigation only and should not be used to make clinical decisions.

The data used contains no patient information and was extracted from a public dataset that can be found here: https://www.kaggle.com/datasets/andrewmvd/malignant-lymphoma-classification

**Preface**

The purpose of this guide is to demonstrate how to use the diagnostic application.

**General Information**

* **What is the Application?**
  + AI-based tool for predicting lymphoma subtype from pathology slide tiles
* **Key Features**
  + Upload & Analyze Patches
  + AI-Based Prediction (ResNet-50)
  + Grad-CAM Visualization
  + Downloadable PDF Reports
* **System Requirements**
  + Browser and Device Compatibility
  + Supported Operating Systems
* **Accessibility Support**
  + High-contrast mode
  + Screen reader-friendly layout
  + Keyboard-only navigation

**System Summary**

* **Overview of Workflow**
  + Input: Tile images
  + Process: Deep learning inference
  + Output: Subtype prediction, Grad-CAM map, PDF report
* **Architecture Diagram**

A diagram of a model

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* **Technology Stack**
  + Streamlit, PyTorch, OpenSlide, Docker, Azure (optional)

**Getting Started**

**Installation**

**For Web App Users**

* No installation required.
* Access the app directly via browser:  
  https://lymphoid-streamlit-app.azurewebsites.net

**For Local Users (Advanced)**  
To run locally:

1. **Download the Repository**
   * Clone from GitHub:

bash

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git clone https://github.com/yourusername/lymphoid\_malignancy\_platform.git

1. **Install Python 3.10+**
2. **Create and Activate Virtual Environment**

bash

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python -m venv env

source env/bin/activate # macOS/Linux

.\env\Scripts\activate # Windows

1. **Install Requirements**

bash

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pip install -r requirements.txt

1. **Run the App**

bash

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streamlit run streamlit\_app.py

**Alternatively**, run the Docker container:

bash

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docker build -t lymphoid-app .

docker run -p 8501:80 lymphoid-app

**Troubleshooting Install Issues**

| **Issue** | **Cause** | **Solution** |
| --- | --- | --- |
| streamlit not found | Virtual environment not activated | Activate environment first |
| Docker build fails | Missing system dependencies | Ensure Docker is installed, try rebuilding |
| Image load error | Path or format issue | Use .jpg, .png, or .tif format tiles only |

**First-Time Setup**

**Loading Sample Data**

* In **Demo Mode**, built-in images will walk you through how the model works.
* In **Interactive Mode**, you may:
  + Upload .jpg, .png, or .tif files
  + Paste a public image URL

**Navigating the Interface**

* Use tabs across the top:
  + Demo Mode: Training pipeline walkthrough
  + Interactive Mode: Upload, classify, visualize, and download reports
  + Help: Usage instructions, tips, and accessibility info

**Accessibility Settings**

* In the sidebar:
  + Toggle “High-contrast mode” for better visibility
  + System reports whether it's running on GPU or CPU

Using the System

**Demo Mode**

**A screenshot of a diagram

AI-generated content may be incorrect.**

This mode guides you through:

1. Pipeline Overview – Flowchart explaining the process
2. Raw Data – Example whole-slide images
3. Tiles – How images are cropped and labeled
4. Training – Augmented tiles and ResNet-50 setup
5. GradCAM – Visual explanation of model attention
6. Evaluation – Confusion matrix and ROC-AUC curve

**Navigation:** Use the “Next” and “Back” buttons to walk through the sections.

**Interactive Mode**

**A screenshot of a computer

AI-generated content may be incorrect.**

**Uploading or Linking Images**

* Upload .jpg, .png, .tif images
* Or paste a public image URL

**Analyzing a Case**

Once an image is uploaded:

1. It is preprocessed, tiled, and passed through the trained ResNet-50 model.
2. A prediction is returned for one of:
   * Chronic Lymphocytic Leukemia (CLL)
   * Follicular Lymphoma (FL)
   * Mantle Cell Lymphoma (MCL)
3. The following analytics are displayed:
   * Descriptive Statistics (Mean [RGB], Median [RGB], Standard Deviation [RGB])
   * Prediction and confidence score
   * Grad-CAM image
   * RGB Histogram
   * Pixel Intensity Distribution

A screenshot of a computer

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**Downloading Reports**

* Click “Generate Analysis Report”



* Generates a PDF with:
  + Original uploaded image
  + Grad-CAM heatmap
  + Image statistics and plots
  + Prediction and confidence

Note: All data is processed in memory — no data is stored

**Troubleshooting**

|  |  |  |
| --- | --- | --- |
| **Issue** | **Possible Cause** | **Solution** |
| App not loading | Browser blocked scripts or Azure down | Refresh browser or check deployment logs |
| Grad-CAM failed | Image too small or unsupported layer | Use 224x224 tile; re-upload |
| PDF export fails | Missing reportlab or file permissions | Reinstall required packages, check local path |
| No prediction returned | Model or file load error | Ensure valid image, model weights exist |
| “Tile too small” | Uploaded image is smaller than 224x224 | Upload a larger or correctly-sized tile |

**Frequently Asked Questions (FAQ)**

**Can I use whole-slide images (.svs, .tif)?**  
Yes, the pipeline will process your whole slide image into tile.

**Is this tool FDA-approved?**  
No. This tool is for research and educational use only, not clinical diagnosis.

**Can I retrain the model?**  
Yes. Use train\_model.ipynb to retrain on your own dataset, or use the CLI training pipeline in scripts/train\_utils.py.

**Help and Contact Details**

Contact: JGarcia641@my.gcu.edu

GitHub Repository: https://github.com/Jacinda-G/-lymphoid-malignancy-classification

**Glossary**

| **Term** | **Description** |
| --- | --- |
| Tile | A small image patch cropped from a histopathology slide |
| Grad-CAM | Visualization tool showing model focus |
| ResNet-50 | Deep convolutional neural network architecture |
| Subtype | A classification of lymphoid malignancy |
| CLAHE | Contrast Limited Adaptive Histogram Equalization |