We’re building an image processing system to classify liver images into four categories:

* **ID 0**: Homogeneous Liver
* **ID 1**: Liver Tumor (or Secondary Determinations)
* **ID 2**: Liver Hemangioma
* **ID 3**: Liver Cyst

**Objectives**

Let’s refine these into clear, actionable goals:

* **Automate Classification**: Create a system that takes liver images as input and outputs one of the four IDs.
* **Support Early Detection**: Ensure the system is accurate enough to help identify hepatic diseases early (e.g., tumors or cysts).
* **High Performance**: Aim for high accuracy (e.g., >85%, inspired by the papers), sensitivity (detecting true positives), and specificity (avoiding false positives).

**Your Input**: Do these objectives align with your vision? Anything you’d like to add or tweak?

**Tools and Resources**

Here’s what we’ll use:

* **Database**: Your 12 GB dataset, split across the 4 categories. (We’ll explore it more in Step 3.)
* **Programming Language**: Python—flexible, widely supported, and perfect for AI.
* **Libraries**:
  + **OpenCV**: For image preprocessing (e.g., resizing, converting formats).
  + **NumPy**: For handling arrays and basic computations.
  + **TensorFlow/Keras**: For building and training deep learning models (CNNs).
  + **Scikit-learn**: For traditional ML (SVM, metrics, splitting data).
  + **Matplotlib**: For visualizing results (e.g., accuracy plots).
* **Hardware**: Do you have access to a GPU? If not, we can optimize for CPU, but a GPU (e.g., NVIDIA) will speed up CNN training.
* **Research Papers**: We’ll lean on the two papers you provided:
  + *IJATEE* (SVM-based, texture/shape features).
  + *European Radiology* (CNN-based, multi-phase imaging).