Image Analysis Exam - ChatGPT Session Summary

Sections Covered:

- CT Kidney Blob Analysis
- Dice Region Classifiers
- PCA on Breast Cancer Dataset
- Gradient Descent & Optimization
- Cell Label Matching and Distance
- Utility Function Design

Key Results:

1. **Blob Analysis (CT Scans)**:
   - Labeled BLOBs after morphological opening and thresholding.
   - Correct counting and border filtering reviewed.

2. **ROI Classifier Evaluation (Dice)**:
   - Minimum distance classifier based on (B, C, D) found to match segmentation pattern.
   - Threshold between D and E computed using:
     - Manual Gaussian formula: ~142
     - QDA Classifier: ~158.26 Correct Answer.

3. **Breast Cancer PCA**:
   - Dataset shape: 569 observations, 30 features
   - Accuracy of PCA classifier: 0.916
   - Samples classified as positive: 349
   - PC1 averages: -2.21 (cancer), 3.71 (no cancer)

- PCA scatter plot (color-coded) was used to visually validate clustering.

4. **Gradient Descent**:

- Visualizations used to match iterative path.

- Cost function convergence tested with different initializations.

5. **Cell Landmark Distance**:

- Euclidean distance between average landmark positions computed: ~7.28

6. **Utility Function Suggestions**:

- Gaussian discriminant threshold (manual)

- QDA 1D classifier and threshold finder

- Blob analysis plotter with optional scaling

Tools and Libraries Used:

- scikit-learn (QDA, datasets)

- numpy (PCA via np.linalg.eig)

- skimage (morphology, labeling)

- matplotlib (visualizations)