Weekly Meeting with Dr. Hannah

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✅ 1. Particle Swarm Optimization (PSO) Implementation and Results

- Particle Swarm Optimization was proposed by Kennedy and Eberhart in 1995.
- As mentioned in the original paper, sociobiologists believe a school of fish or a flock of birds that moves in a group “can profit from the experience of all other members”.
- In other words, while a bird flying and searching randomly for food, for instance, all birds in the flock can share their discovery and help the entire flock get the best hunt.

✅ 1. Particle Swarm Optimization (PSO) Implementation and Results

Particle Swarm Optimization is a nature-inspired optimization algorithm based on the social behavior of bird flocking or fish schooling. In PSO, each solution (called a particle) navigates the search space to find the optimal solution by adjusting its position based on:

- Its own best position (personal best)
- The best position found by the swarm (global best)

PSO is particularly effective for high-dimensional optimization problems and is well-suited for feature selection in radiomics where the search space is large.

✅ 1. Particle Swarm Optimization (PSO) Implementation and Results

Model	Training ROC AUC	Training Accuracy	Test ROC AUC	Test Accuracy
Logistic Regression	0.74 (0.66-0.84)	71.57%	0.54 (0.30-0.78)	57.69%
Support Vector Machine	0.73 (0.63-0.83)	69.61%	0.55 (0.30-0.80)	57.69%
Naïve Bayes	0.72 (0.61-0.83)	72.55%	0.60 (0.38-0.81)	61.54%

Current Results Using PSO with Logistic Regression:

✅ **Train AUC:** 0.9479

✅ **Train Accuracy:** 0.8784

❌ **Test AUC:** 0.4286

❌ **Test Accuracy:** 0.4737

🔜 Planned Future Work – Classifiers vs Feature Selection Techniques

In the upcoming weeks, I plan to test the following classifiers:

- Logistic Regression
- Naive Bayes
- Linear Support Vector Machine (Linear SVM)
- Radial Basis Function Kernel SVM (RBF SVM)
- Decision Tree
- Random Forest
- Gradient Boosting (e.g., XGBoost, LightGBM)
- Voting Classifier
- Stacking Classifier
- Multi-Layer Perceptron Classifier (MLPClassifier)

These classifiers will be evaluated in combination with the following feature selection/optimization techniques:

- SelectKBest (Univariate statistical selection)
- Least Absolute Shrinkage and Selection Operator (LASSO)
- Particle Swarm Optimization (PSO)
- Whale Optimization Algorithm (WOA)
- Grey Wolf Optimizer (GWO)
- Genetic Algorithm (GA)
- Simulated Annealing (SA)

This results in a total of 70 unique combinations (10 classifiers × 7 feature selection techniques) that I plan to implement, test, and analyze to identify the most robust combination for our radiomics-based prediction task.