Weekly Meeting with Dr. Hannah

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Abstract Submission

- Submitted abstract for 15th Research Day at CMC Vellore titled: **“Before We Treat, Can We Tell? A Locoregional Recurrence Signature in Head & Neck Cancer”**

Table 1: Performance comparison of ML models **using radiomics features**. ROC-AUC with 95% CI values is reported for (**"Train/Validation/Test"**)

Classifier	LASSO	SelectKBest	Particle Swarm Optimization	Whale Optimization Algorithm	Grey Wolf Optimizer	Genetic Algorithm	Simulated Annealing
Logistic Regression	0.72 [0.61, 0.80] | 0.64 [0.55, 0.70] | 0.64 [0.42, 0.83]	0.70 [0.60, 0.79] | 0.66 [0.60, 0.72] | 0.65 [0.40, 0.86]	0.70 [0.61, 0.80] | 0.65 [0.52, 0.79] | 0.65 [0.41, 0.85]	0.71 [0.60, 0.79] | 0.64 [0.55, 0.80] | 0.64 [0.41, 0.85]	0.71 [0.60, 0.80] | 0.65 [0.55, 0.78] | 0.69 [0.47, 0.88]	0.73 [0.61, 0.80] | 0.63 [0.53, 0.70] | 0.62 [0.40, 0.83]	0.70 [0.61, 0.80] | 0.63 [0.57, 0.70] | 0.65 [0.41, 0.87]
Naive Bayes	0.73 [0.62, 0.80] | 0.64 [0.59, 0.73] | 0.68 [0.47, 0.86]	0.71 [0.60, 0.80] | 0.63 [0.55, 0.79] | 0.65 [0.40, 0.87]	0.72 [0.63, 0.81] | 0.61 [0.51, 0.76] | 0.69 [0.48, 0.88]	0.73 [0.63, 0.81] | 0.56 [0.45, 0.75] | 0.66 [0.47, 0.84]	0.73 [0.62, 0.80] | 0.66 [0.50, 0.87] | 0.71 [0.50, 0.89]	0.75 [0.63, 0.82] | 0.62 [0.55, 0.73] | 0.67 [0.47, 0.84]	0.71 [0.61, 0.80] | 0.64 [0.59, 0.73] | 0.65 [0.43, 0.83]
SVM	0.63 [0.55, 0.70] | 0.59 [0.49, 0.79] | 0.36 [0.17, 0.59]	0.64 [0.61, 0.81] | 0.58 [0.50, 0.66] | 0.64 [0.39, 0.85]	0.29 [0.20, 0.39] | 0.35 [0.29, 0.50] | 0.35 [0.15, 0.60]	0.29 [0.21, 0.40] | 0.36 [0.31, 0.58] | 0.36 [0.15, 0.60]	0.30 [0.20, 0.40] | 0.36 [0.24, 0.55] | 0.32 [0.14, 0.54]	0.28 [0.20, 0.43] | 0.37 [0.32, 0.50] | 0.63 [0.39, 0.85]	0.29 [0.20, 0.38] | 0.35 [0.30, 0.50] | 0.36 [0.15, 0.60]
Decision Tree	0.84 [0.78, 0.91] | 0.55 [0.50, 0.80] | 0.68 [0.48, 0.85]	0.82 [0.78, 0.91] | 0.47 [0.40, 0.55] | **0.73 [0.53, 0.88]**	0.86 [0.77, 0.91] | 0.52 [0.43, 0.85] | 0.63 [0.42, 0.82]	0.84 [0.71, 0.85] | 0.58 [0.53, 0.76] | 0.55 [0.35, 0.73]	0.82 [0.75, 0.90] | 0.54 [0.49, 0.73] | 0.66 [0.48, 0.83]	0.86 [0.72, 0.90] | 0.57 [0.51, 0.61] | 0.65 [0.46, 0.82]	0.83 [0.75, 0.97] | 0.55 [0.47, 0.63] | 0.53 [0.30, 0.76]
Random Forest	0.92 [0.83, 0.94] | 0.56 [0.51, 0.73] | 0.67 [0.45, 0.84]	0.92 [0.81, 0.93] | 0.60 [0.53, 0.78] | 0.63 [0.40, 0.84]	0.90 [0.83, 0.94] | 0.59 [0.50, 0.77] | 0.66 [0.44, 0.84]	0.91 [0.82, 0.93] | 0.61 [0.50, 0.73] | 0.62 [0.41, 0.80]	0.91 [0.80, 0.97] | 0.54 [0.44, 0.70] | 0.68 [0.48, 0.86]	0.92 [0.82, 0.94] | 0.63 [0.48, 0.72] | 0.62 [0.41, 0.80]	0.90 [0.85, 0.95] | 0.59 [0.50, 0.69] | 0.65 [0.42, 0.84]

Table 2: Performance comparison of ML models **using radiomics + clinical features**. ROC-AUC with 95% CI values is reported for (**"Train/Validation/Test"**)

Classifier	LASSO	SelectKBest	Particle Swarm Optimization	Whale Optimization Algorithm	Grey Wolf Optimizer	Genetic Algorithm	Simulated Annealing
Logistic Regression	0.80 [0.69, 0.85] | 0.66 [0.60, 0.71] | 0.78 [0.58, 0.94]	0.73 [0.60, 0.79] | 0.66 [0.59, 0.70] | 0.66 [0.42, 0.88]	0.77 [0.72, 0.87] | 0.72 [0.66, 0.76] | 0.74 [0.52, 0.92]	0.80 [0.74, 0.79] | 0.66 [0.55, 0.75] | 0.62 [0.49, 0.83]	0.78 [0.71, 0.86] | 0.65 [0.59, 0.71] | 0.81 [0.62, 0.95]	0.79 [0.70, 0.85] | 0.63 [0.58, 0.71] | 0.75 [0.54, 0.92]	0.76 [0.69, 0.86] | 0.64 [0.55, 0.70] | 0.74 [0.52, 0.92]
Naive Bayes	0.78 [0.66, 0.83] | 0.66 [0.59, 0.73] | 0.71 [0.50, 0.91]	0.74 [0.60, 0.80] | 0.67 [0.55, 0.69] | 0.63 [0.38, 0.86]	0.75 [0.66, 0.84] | 0.64 [0.57, 0.69] | 0.67 [0.43, 0.89]	0.73 [0.65, 0.82] | 0.60 [0.53, 0.73] | 0.68 [0.57, 0.83]	0.77 [0.69, 0.86] | 0.69 [0.60, 0.73] | 0.79 [0.60, 0.93]	0.80 [0.65, 0.84] | 0.65 [0.57, 0.75] | 0.75 [0.54, 0.91]	0.74 [0.64, 0.83] | 0.64 [0.58, 0.72] | 0.73 [0.52, 0.90]
SVM	0.82 [0.76, 0.90] | 0.67 [0.58, 0.73] | 0.78 [0.57, 0.94]	0.75 [0.61, 0.81] | 0.68 [0.50, 0.63] | 0.35 [0.13, 0.58]	0.56 [0.50, 0.63] | 0.54 [0.48, 0.60] | 0.72 [0.50, 0.90]	0.56 [0.37, 0.49] | 0.49 [0.43, 0.56] | 0.34 [0.28, 0.56]	0.57 [0.50, 0.67] | 0.56 [0.50, 0.62] | 0.79 [0.62, 0.93]	0.57 [0.50, 0.65] | 0.55 [0.49, 0.60] | 0.74 [0.52, 0.93]	0.56 [0.47, 0.63] | 0.57 [0.50, 0.63] | 0.74 [0.53, 0.91]
Decision Tree	0.89 [0.83, 0.93] | 0.63 [0.51, 0.68] | 0.59 [0.38, 0.76]	0.85 [0.65, 0.82] | 0.62 [0.40, 0.52] | 0.68 [0.46, 0.87]	0.84 [0.79, 0.90] | 0.61 [0.55, 0.66] | 0.45 [0.25, 0.64]	0.83 [0.76, 0.90] | 0.53 [0.50, 0.69] | 0.58 [0.50, 0.70]	0.84 [0.79, 0.90] | 0.55 [0.48, 0.63] | 0.60 [0.40, 0.80]	0.85 [0.80, 0.92] | 0.54 [0.49, 0.60] | 0.62 [0.41, 0.80]	0.84 [0.75, 0.90] | 0.56 [0.49, 0.65] | 0.70 [0.49, 0.88]
Random Forest	0.98 [0.95, 0.99] | 0.67 [0.59, 0.76] | 0.68 [0.45, 0.88]	0.93 [0.80, 0.93] | 0.67 [0.55, 0.69] | 0.64 [0.40, 0.85]	0.92 [0.90, 0.95] | 0.55 [0.50, 0.61] | 0.67 [0.43, 0.86]	0.94 [0.86, 0.97] | 0.59 [0.51, 0.70] | 0.64 [0.57, 0.71]	0.92 [0.90, 0.96] | 0.56 [0.51, 0.64] | 0.73 [0.55, 0.89]	0.94 [0.90, 0.97] | 0.71 [0.58, 0.76] | 0.74 [0.53, 0.92]	0.93 [0.87, 0.96] | 0.57 [0.48, 0.63] | 0.72 [0.51, 0.89]

Table 3: Performance comparison of ML models **with hybrid feature selection pipelines (Bootstrap-LASSO + metaheuristics) using radiomics features.** ROC-AUC with 95% CI values is reported for (**"Train/Validation/Test"**)

Classifier	Particle Swarm Optimization	Whale Optimization Algorithm	Grey Wolf Optimizer	Genetic Algorithm	Simulated Annealing
Logistic Regression	0.73 [0.61, 0.81] | 0.64 [0.49, 0.70] | 0.66 [0.45, 0.86]	0.73 [0.62, 0.81] | 0.61 [0.50, 0.75] | 0.65 [0.43, 0.85]	0.74 [0.61, 0.80] | 0.62 [0.50, 0.82] | 0.66 [0.44, 0.86]	0.73 [0.62, 0.81] | 0.64 [0.48, 0.73] | 0.65 [0.41, 0.85]	0.73 [0.62, 0.81] | 0.61 [0.55, 0.75] | 0.68 [0.45, 0.87]
Naive Bayes	0.74 [0.62, 0.80] | 0.63 [0.53, 0.74] | 0.71 [0.50, 0.89]	0.74 [0.64, 0.82] | 0.64 [0.51, 0.80] | 0.71 [0.50, 0.88]	0.74 [0.63, 0.81] | 0.67 [0.59, 0.89] | 0.72 [0.51, 0.89]	0.75 [0.64, 0.83] | 0.65 [0.58, 0.80] | 0.68 [0.46, 0.87]	0.75 [0.63, 0.83] | 0.60 [0.40, 0.80] | 0.72 [0.51, 0.88]
SVM	0.53 [0.20, 0.40] | 0.45 [0.31, 0.65] | 0.34 [0.15, 0.56]	0.56 [0.40, 0.65] | 0.48 [0.30, 0.55] | 0.35 [0.15, 0.57]	0.56 [0.20, 0.40] | 0.48 [0.40, 0.77] | 0.34 [0.15, 0.55]	0.57 [0.20, 0.39] | 0.51 [0.34, 0.63] | 0.36 [0.15, 0.59]	0.57 [0.20, 0.38] | 0.48 [0.33, 0.68] | 0.32 [0.15, 0.55]
Decision Tree	0.91 [0.67, 0.95] | 0.58 [0.38, 0.68] | 0.64 [0.44, 0.81]	0.90 [0.81, 0.93] | 0.65 [0.50, 0.78] | 0.67 [0.46, 0.84]	0.92 [0.75, 0.95] | 0.53 [0.45, 0.64] | 0.53 [0.34, 0.71]	0.92 [0.89, 0.96] | 0.59 [0.41, 0.72] | 0.59 [0.37, 0.78]	0.92 [0.68, 0.83] | 0.55 [0.40, 0.75] | 0.62 [0.43, 0.79]
Random Forest	0.93 [0.88, 0.96] | 0.60 [0.51, 0.70] | 0.72 [0.54, 0.88]	0.93 [0.87, 0.96] | 0.61 [0.45, 0.66] | 0.70 [0.50, 0.88]	0.93 [0.85, 0.95] | 0.61 [0.55, 0.82] | 0.69 [0.47, 0.87]	0.94 [0.87, 0.96] | 0.55 [0.42, 0.71] | 0.67 [0.45, 0.85]	0.93 [0.87, 0.96] | 0.55 [0.43, 0.83] | 0.69 [0.48, 0.87]

Table 4: Performance comparison of ML models **with hybrid feature selection pipelines (Bootstrap-LASSO + metaheuristics) using radiomics + clinical features.** ROC-AUC with 95% CI values is reported for (**"Train/Validation/Test"**)

Classifier	Particle Swarm Optimization	Whale Optimization Algorithm	Grey Wolf Optimizer	Genetic Algorithm	Simulated Annealing
Logistic Regression	0.79 [0.72, 0.87] | 0.70 [0.60, 0.76] | 0.75 [0.54, 0.92]	0.71 [0.67, 0.84] | 0.56 [0.50, 0.66] | 0.70 [0.47, 0.88]	0.80 [0.71, 0.86] | 0.69 [0.61, 0.78] | 0.75 [0.53, 0.93]	0.81 [0.74, 0.89] | 0.70 [0.60, 0.71] | 0.74 [0.53, 0.91]	0.79 [0.75, 0.89] | 0.63 [0.55, 0.71] | 0.74 [0.51, 0.93]
Naive Bayes	0.79 [0.67, 0.84] | 0.63 [0.53, 0.68] | 0.71 [0.49, 0.90]	0.72 [0.69, 0.85] | 0.63 [0.56, 0.69] | 0.77 [0.58, 0.92]	0.79 [0.66, 0.84] | 0.62 [0.55, 0.71] | 0.77 [0.57, 0.93]	0.80 [0.70, 0.86] | 0.62 [0.54, 0.70] | 0.69 [0.46, 0.89]	0.79 [0.69, 0.84] | 0.64 [0.54, 0.73] | 0.74 [0.52, 0.91]
SVM	0.80 [0.76, 0.91] | 0.66 [0.55, 0.70] | 0.68 [0.45, 0.88]	0.66 [0.61, 0.73] | 0.56 [0.49, 0.63] | 0.74 [0.53, 0.90]	0.80 [0.70, 0.87] | 0.66 [0.58, 0.69] | 0.69 [0.46, 0.90]	0.81 [0.71, 0.87] | 0.65 [0.60, 0.73] | 0.69 [0.45, 0.89]	0.80 [0.70, 0.87] | 0.67 [0.58, 0.70] | 0.67 [0.42, 0.88]
Decision Tree	0.86 [0.77, 0.90] | 0.55 [00, 0.60] | 0.68 [0.44, 0.90]	0.84 [0.80, 0.91] | 0.51 [0.46, 0.59] | 0.61 [0.38, 0.80]	0.85 [0.75, 0.88] | 0.52 [0.44, 0.65] | 0.71 [0.52, 0.87]	0.86 [0.79, 0.91] | 0.55 [0.49, 0.65] | 0.63 [0.42, 0.83]	0.87 [0.80, 0.92] | 0.59 [0.45, 0.68] | 0.54 [0.32, 0.75]
Random Forest	0.95 [0.92, 0.98] | 0.63 [0.53, 0.69] | 0.68 [0.44, 0.88]	0.95 [0.89, 0.96] | 0.69 [0.61, 0.75] | 0.75 [0.55, 0.92]	0.96 [0.93, 0.98] | 0.59 [0.50, 0.69] | 0.72 [0.49, 0.91]	0.96 [0.86, 0.98] | 0.63 [0.58, 0.70] | 0.69 [0.45, 0.90]	0.95 [0.86, 0.98] | 0.62 [0.55, 0.70] | 0.75 [0.53, 0.94]