



Weekly Meeting with Dr. Hannah

Hasan Shaikh

Quantitative Imaging Research and
Artificial Intelligence Lab (QIRAIL)

Presentation Template for Research Day talk (4-5 minutes):

Slide 1: Title Slide

- Title: "Before We Treat, Can We Tell? A Locoregional Recurrence Signature in Head & Neck Cancer"
- Authors: Hasan Shaikh*, Amal Joseph Varghese*, et al.
- Affiliation: Quantitative Imaging Research and AI Lab, Dept. of Radiation Oncology, CMC Vellore
- Conference: 15th Research Day, CMC Vellore | October 30-31, 2025

Slide 2: Background & Problem Statement (30-40 sec)

- Locoregional recurrence (LRR) affects 50-60% of HNC patients
- Current staging has limited predictive power for individual patients
- **The Challenge:** High-dimensional radiomics ($p \gg n$) → unstable feature selection
- **Visual:** Infographic showing recurrence rates or staging limitations

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Slide 3: Research Question & Approach (20-30 sec)

- **Can we identify an interpretable, sparse signature for LRR prediction?**
- Compare 3 feature selection strategies + 5 classifiers
- Focus on stability and generalization, not just accuracy
- **Visual:** Simple concept flow: CT → Features → Explainable Model → Clinical Decision

Slide 4: Study Design & Methods (50 sec)

- **Cohort:** 163 HNC patients (55 LRR, 108 disease-free)
- **Features:** 103 radiomics + 8 clinical variables
- **Selection Methods:** LASSO, SelectKBest, Metaheuristics (GWO, PSO, WOA, GA, SA)
- **Classifiers:** Logistic Regression, SVM, Random Forest, Decision Tree, Naïve Bayes
- **Validation:** 80/20 split, 5-fold CV, no data leakage
- **Visual:** Methodological flowchart

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Slide 5: Key Results - Best Model Performance (40 sec)

- **Winner:** Logistic Regression + GWO (radiomics + clinical)
 - Test AUC: 0.81 [0.62-0.95]
- Clinical variables crucial for performance boost
- **Visual:** ROC curve with confidence intervals; comparison bar chart

Slide 6: The 10-Feature Signature (30 sec)

- **4 Clinical Features:**
 - Age, AJCC Stage, T Stage, Location
- **6 Radiomics Features:**
 - **Shape:** Maximum2DDiameterSlice, MinorAxisLength
 - **Texture:** LargeDependenceEmphasis, RunLengthNonUniformityNormalized, Idm, Imc1
- **Visual:** Feature list with icons; maybe a feature importance/coefficient plot

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Slide 7: Feature Explainability - Clinical Variables (40-50 sec)

Why these clinical features make sense:

Clinical Variables:

- **Age:** Older patients → altered immune response, comorbidities → worse treatment tolerance
- **AJCC Stage:** Captures overall disease burden; advanced stage = higher recurrence risk
- **T Stage:** Primary tumor size/extent → larger tumors harder to control locally
- **Location:** Different subsites have varying vascularity, lymphatic drainage, and accessibility

Visual:

- Table or infographic showing each variable with brief biological rationale
- Icons representing each concept

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Slide 8: Feature Explainability - Radiomics (Shape & Texture) (50-60 sec)

Why these imaging features predict recurrence:

Shape Features (Tumor Geometry):

- **Maximum2DDiameterSlice:** Larger cross-sectional area → more aggressive, harder to eradicate
- **MinorAxisLength:** Irregular/elongated tumors → infiltrative growth pattern → recurrence prone

Texture Features (Tumor Heterogeneity):

- **LargeDependenceEmphasis:** Captures large homogeneous regions → necrotic/hypoxic areas → radioresistance
- **RunLengthNonUniformityNormalized:** Measures texture uniformity → high values = chaotic, aggressive phenotype
- **Idm (Inverse Difference Moment):** Local homogeneity → low values = heterogeneous microenvironment
- **Imc1 (Informational Measure of Correlation):** Texture complexity → reflects genetic/metabolic heterogeneity

Key Insight: Heterogeneous, irregular tumors with hypoxic regions are harder to control with radiation

Visual:

- Consider heatmap or example tumor contours

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Slide 9: Model Interpretability - Putting It Together (30 sec)

How the model makes predictions:

Visual options:

- **Feature coefficient plot** (for Logistic Regression): Show positive/negative coefficients
- **SHAP summary plot** (if you computed it): Shows feature contribution for individual predictions
- **Example case:** "High-risk patient: Age 65, Stage IV, Large heterogeneous tumor → 78% recurrence probability"

Key Message: The model uses biologically plausible features that clinicians already consider intuitively

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Slide 10: Clinical Implications & Conclusion (30 sec)

- **Interpretable model** (10 features) achieves strong prediction (AUC 0.81)
- Features align with known biology of aggressive tumors
- **Clinical Utility:**
 - High-risk patients → intensified treatment/closer follow-up
 - Low-risk patients → potential de-escalation
- Simple enough for clinical implementation

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Slide 11: Limitations & Future Work (20 sec)

Limitations:

- Single-center prospective study
- Need external validation

Next Steps:

- Multi-center validation
- Decision curve analysis for net clinical benefit

Slide 12: Acknowledgements (10 sec)

- Team, department, patients
- Contact: hasan.shaikh.inst@cmcvellore.ac.in