# MRI-Derived Radiomics and Deep Learning Models for Predicting Epidermal Growth Factor Receptor Mutation Status in Lung Cancer Brain Metastasis; A Systematic Review and Meta-analysis

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## Background

- Metastases are the most common malignant tumors in the central nervous system.
- Lung cancer is the most common malignancy that metastasize to the brain, comprising about half of brain metastasis (BM) cases.
- Identifying epidermal growth factor receptor (EGFR) in these patients impacts the therapeutic approach.
- Current routine diagnostic methods require tissue samples obtained through needle biopsy or surgical resection, both of which are invasive procedures with potential risks and complications.
- These limitations highlight the need for non-invasive alternatives to identify EGFR mutation status in patients with lung caner BMs.

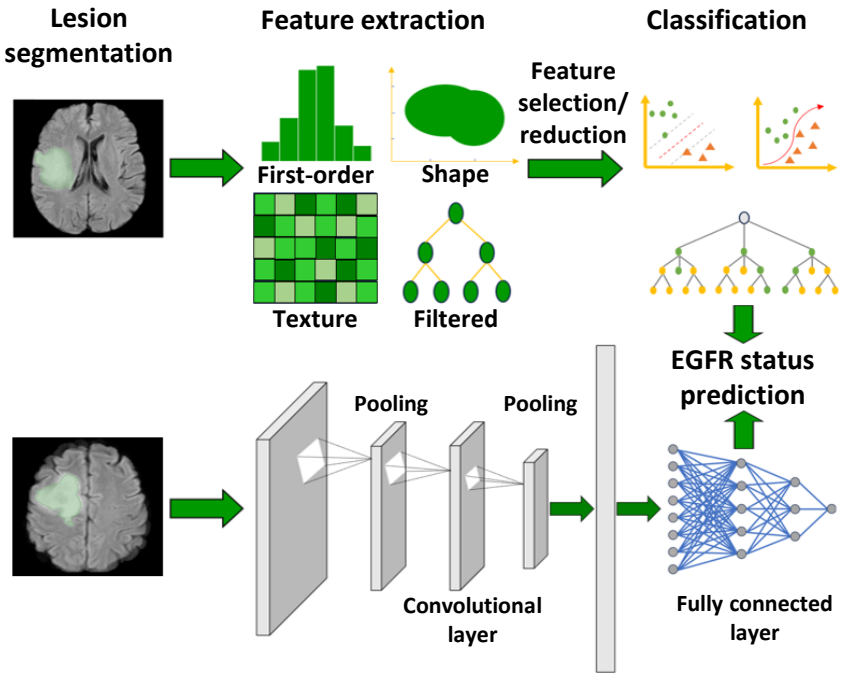
## Results

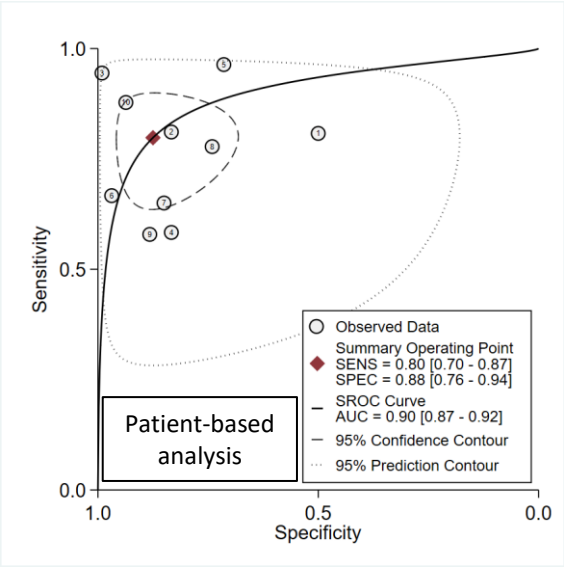
- Twenty-one studies were included in the systematic review. A meta-analysis of ten radiomics studies with patient-based reports yielded a pooled sensitivity of 0.80, specificity of 0.88, DLR+ of 6.38, DLR- of 0.23, and AUC of 0.90.
- Regarding lesion-based analysis, we found a pooled sensitivity of 0.81, specificity of 0.78, DLR+ of 3.60, DLR- of 0.25, and AUC of 0.86 for radiomics models.
- Subgroup analysis revealed significant differences based on the cohort used for meta-analysis and the top-performing classifier.

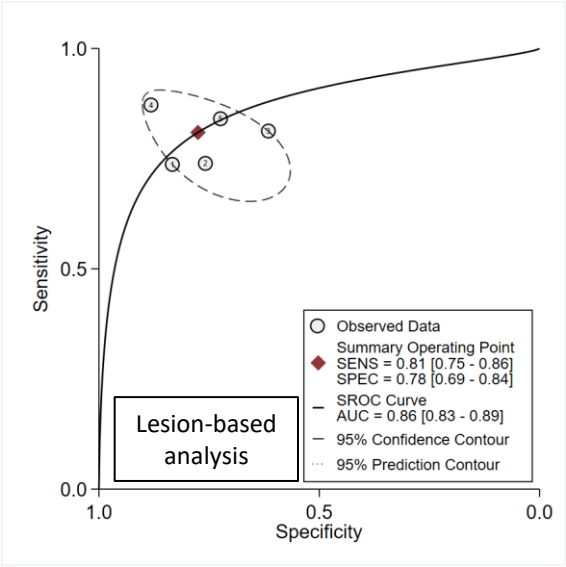
| Variable | Subgroup | No. of studies | Sensitivity | p | Specificity | p |
|---|---|---|---|---|---|---|
| **Cohort used for meta-analysis** | Train or holdout internal validation | 5 | 0.81 | 0.92 | 0.93 | **0.01** |
| | External validation | 5 | 0.81 | | 0.87 | |
| **Best-performing algorithm** | Logistic regression | 7 | 0.74 | **0.01** | 0.87 | 0.73 |
| | Random forest | 3 | 0.93 | | 0.84 | |

## Methods

- A comprehensive systematic search was conducted across PubMed, Scopus, Embase, and Web of Science.
- Studies that developed MRI-derived radiomics and/or deep learning (DL) models for the binary classification of EGFR mutation status in lung cancer patients with BMs were included.
- A bivariate model was employed to compute pooled estimates of sensitivity, specificity, positive likelihood ratio (DLR+), negative likelihood ratio (DLR-), diagnostic odds ratio (DOR), and area under the curve (AUC).




## Conclusion

MRI-based radiomics models may have the potential to serve as a non-invasive alternative to tissue biopsy for identifying EGFR mutations in patients with lung caner BMs. Future research may further assess the predictive performance of DL algorithms for this task.