The Pulmonologist Perspective: Probability of Malignancy is determined by integration of clinical and imaging features.

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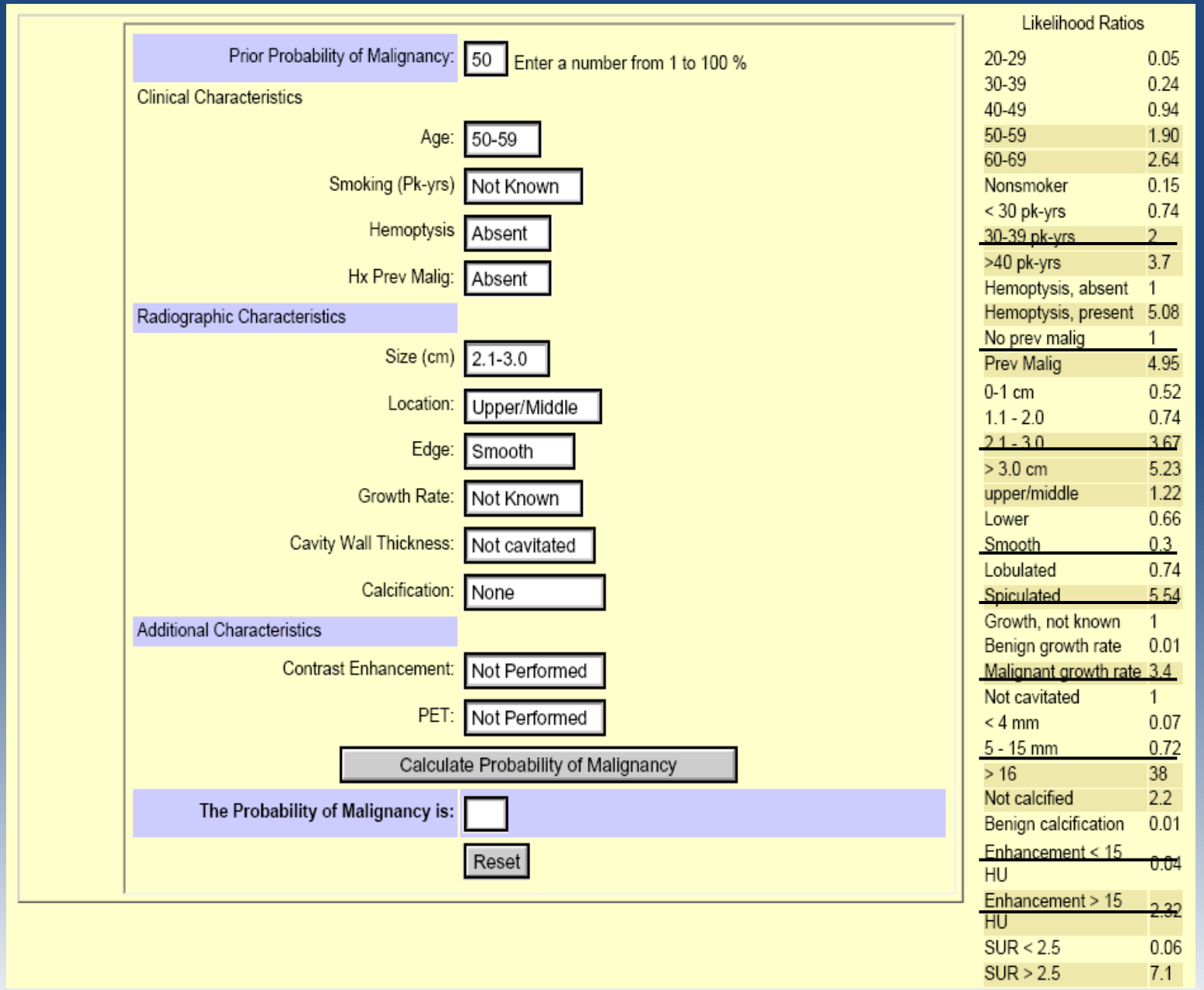

http://www.chestx-ray.com/SPN/SPNProb.html

What Tool Characteristics Will be Most Helpful

Automated Tool that functions as “second reader”

Features designed to maximize sensitivity, such that the test is analogous the D-Dimer assay for diagnosis of Pulmonary Embolism (a negative test essentially rules out disease)

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Computer-Aided Diagnosis (CADx) for Lung Cancer

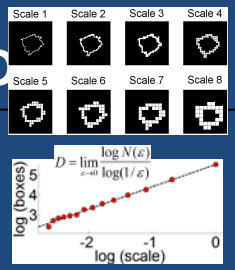
Computer-Aided Diagnosis (CADx)

- the next step after detection
- aims at the ***characterization*** of abnormalities in medical images
- uses image analysis and machine learning for evidence integration to help ***determine whether or not a lesion is cancerous***

194 image-based features

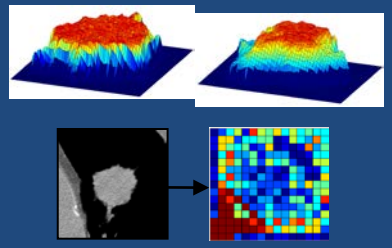
56 2D + 56 2½D + 82 3D

fractal analysis



shape analysis

texture



22 clinical features

- **basic patient demographics (age, gender)**
- **clinical risk factors (prior chest surgery, emphysema, lymph node status, satellite nodules)**

PHILIPS

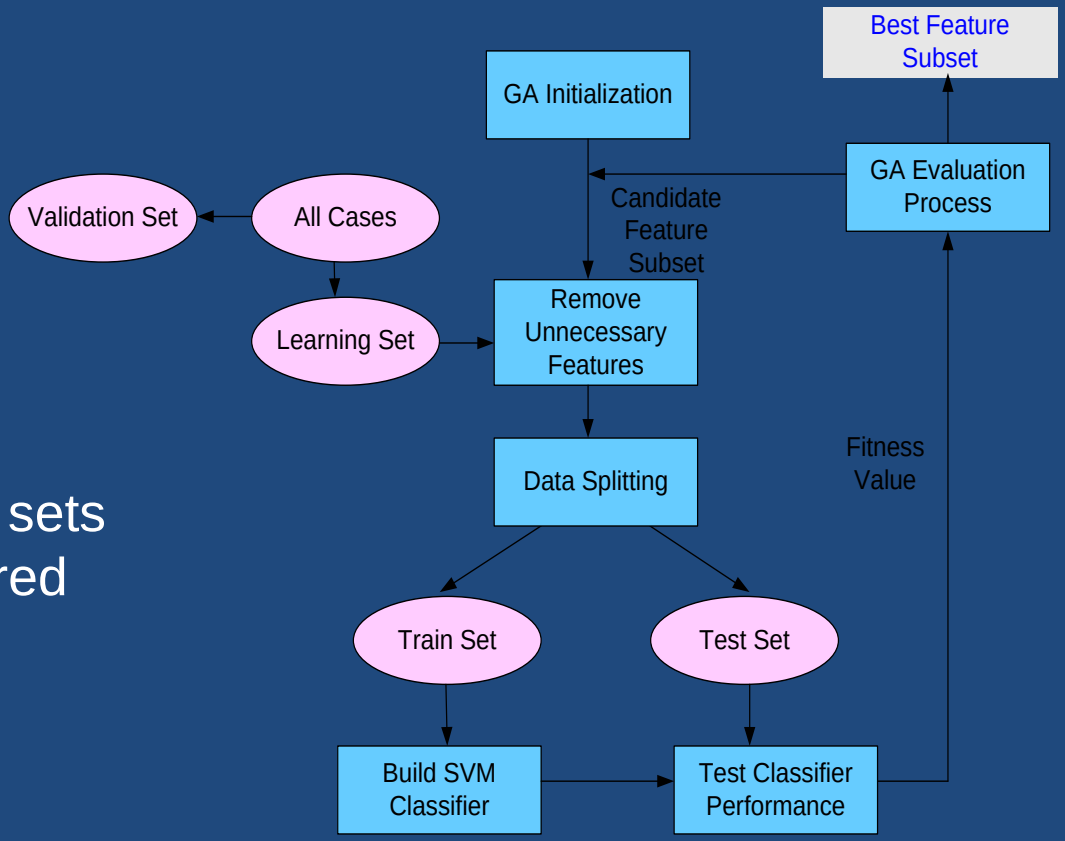
Feature Selection – Genetic Algorithm

Identify the truly relevant features for diagnosis:

- Improve accuracy of classifier
- More computationally efficient

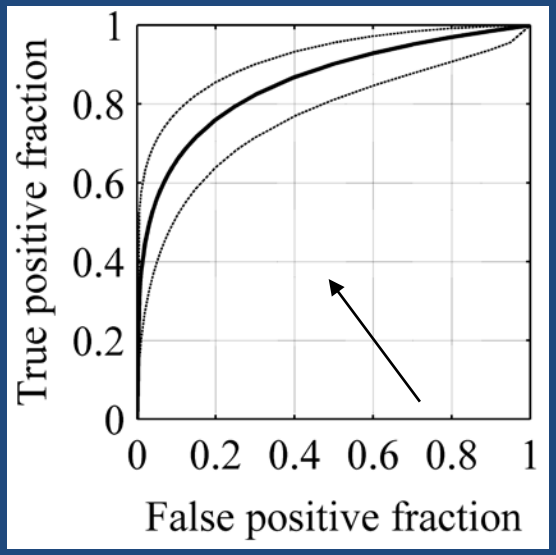
Genetic Algorithm

- Optimization technique that iteratively evaluates feature sets
- Optimal feature set discovered by evolutionary process



Boroczky L "Feature subset selection for improving the performance of false positive reduction in lung nodule CAD", IEEE Trans Inf Technol Biomed. 2006; 10(3):504–11.

Validation (leave one out) n=128



Leave-one-out validation using two-step Genetic Algorithm-ensemble SVM ensemble classifier

sensitivity:	90%
specificity:	71%
PPV:	76%
NPV:	88%
Az:	0.85 *(0.77-0.90 C.I.)*

Conclusion

- A CADx system based on an SVM ensemble has been proposed
- Combined 2D and 3D analysis can give robustness to scan parameters
- Results suggest the advantage of ensemble classifiers over individual classifiers in achieving a reliable prediction of malignancy of pulmonary nodules
- Components can be generalized beyond lung cancer diagnosis