Intelligent Image-based Lung Nodule Classification

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Background
- Lung nodules are small masses of tissue in the lung and typically round in shape; however, they are usually distorted by the surrounding anatomical structures.
- 20% of medical cases with lung nodules represent cancers. Hence, distinguishing malignant nodules from benign ones is essential for early detection of lung cancer.
- Image-based diagnosis computes the quantitative attributes to investigate the correlation between different types of lung nodules.

Dataset
- Early Lung Cancer Action Program (ELCAP) database.
- Provided by the ELCAP and Vision and Image Analysis (VIA) research groups.
- 50 sets of Low-dose computed tomography (LDCT) images.

Component 2: Overlapping nodules discovery
Identify intermediate nodules between different categories
- Descriptor extraction
- SVM classification
- Similarity network construction
- Overlapping nodule identification

Component 4: Contextual semantic classification
Contextual analysis : surrounding anatomical structures
- Concentric level partition
  - Level-nodule and Level-context
- FS3 feature extraction
  - SIFT, MR8+LBP, and HOG
- Latent semantic analysis classification
  - Lung nodule image prediction with contextual voting

Lung nodule classification
According to their relative positions to the surrounding structures.

Four categories:
- Well-circumscribed (W)
- Vascularized (V)
- Juxta-pleural (J)
- Pleural-tail (P)

Component 1: Context curve descriptor
Feature description including both nodule and surrounding structures
- Patch division
- Superpixel labeling
- Context curve construction

Component 3: Ranking-based image classification
Semi-supervised method using both labeled and unlabeled images
- Bipartite graph construction
- Ranking score calculation

Results

Acknowledgements:
This project was supported in part by Australian Research Council (ARC) grants, with research collaborators from Royal Prince Alfred (RPA) Hospital, Australia, and Johns Hopkins University School of Medicine, USA.

Related research publications:

Conclusions:
- Better classification performance compared to the state-of-the-art methods.
- Beneficial for early detection of lung cancer.
- Potentials for large scale imaging data analysis.