

## Histological analysis of lung tumor tissue features

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# Outline

- About the lung cancer
  - Lung cancer
  - Histological classification
- Lung histological features analysis
  - Material: NSCLC tumor, pathology processing
  - Cell detection
  - Correlation between cell density and DWI MRI
  - Vessel reconstruction
- Conclusion



### Lung cancer

#### Mortality rate for lung cancer





- New cases world-wide 2012 1.8 million<sup>[1]</sup>
- Death rate world-wide 2012 1.59 million <sup>[1]</sup>
- Europe highest incidence rate with 53.5 death per 100,000 inhabitants <sup>[1]</sup>
- Costs for lung cancer treatment 18.8 billion € <sup>[2]</sup>

 World Cancer Report, Edited by Bernard Stewart and Christopher P. Wild, ISBN 978-92-832-0429-9
FERNANDEZ, R.L., et al. Economic burden of cancer Gross the European Union: a population based cost analysis. The Lancet Oncology. 2013, Vol. 14, Iss. 12, pp. 1164-1174. ISSN 1470-2045.



### Lung cancer



- Lung cancers are classified based on histological type<sup>[3]</sup>.
  - small-cell lung carcinoma (SCLC)
  - non-small-cell lung carcinoma (NSCLC)
  - Lung Carcinoid Tumor

#### Non Small Cell Lung Cancer



### Lung cancer histology provides a basis for diagnosis and therapy

[3] Lu, C; Onn A, Vaporciyan AA et al. (2010). "78: Cancer of the Lung". Holland-Frei Cancer Medicine (8th ed.). People's Medical Publishing House.



### NSCLC tumor histological image



B Müller / K Breuhahn / A Warth / O Sedlaczek

Priori clinical and \_\_\_\_\_\_ radiological indications Pathology processing Cutting and staining

Scanning Hamamatsu NanoZoomer

### Lung cancer: staining strategy



KL1 stain: cancer cell

CD146 stain: blood vessel

- anti-CD146/MCAM (polyclonal, Atlas Antibodies, Stockholm, Sweden),
- and an anti-pan cytokeratin antibody (clone KL1, Abcam, Cambridge, UK).



### Nuclei detection: image processing



Color deconvolution —> Initial seed points detection—

Nuclei segmentation and classification



### **Different tumor tissues**



#### Squamous cell carcinoma



#### Adenocarcinoma

#/mm <sup>2</sup>	Cell density	Cancer cell	Non-cancer cell
Squamous cell carcinoma	4400	2700	1700
Adenocarcinoma	2900	1600	1300



## Cell density quantitative analysis



Sky Gun

## DWI MRI



D-values of pixels along the tumor center line



### Cell density v.s Diffusion

cut

**DWI MRI diffusion estimation: O Sedlaczek** 



DWI - MRI



Tumor slice





#### **Negative correlation**



### **Vessel detection**



Original image



**Registration: J.s Lotz / J.Olesch** Resolution: 1.821µm Magnification : ~=5X Size: 4.5 \* 4.5 mm<sup>2</sup>



Big vessel diameter: ~=30pixel \*1.821 ~= 55µm



Binary result: 2D vessel cross-sections





## Conclusion

- Quantitative analysis of lung histological tumor tissue features
  - Cancer and non-cancer cells segmentation
  - Blood vessel detection and segmentation
- Study of correlation between DWI MRI and histology
  - Diffusion coefficient estimation
  - Cell density calculation of tumor blocks



### Thank you for your attention

### Any Questions?

