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Using computer vision and artificial intelligence to improve lung neuroendocrine tumours (LNET) classification.

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Background: Pulmonary carcinoids are rare and understudied diseases that account for 1-2% of all invasive lung malignancies. Recently, we performed the first multi-omics characterization of atypical carcinoids, unveiling the existence of the supra-carcinoids and providing the missing pieces for a complete characterization of lung neuroendocrine neoplasms. **Aims:** We are now aiming at using computer vision and artificial intelligence algorithm on whole-slide tissue images to identify the most clinically relevant morphological features. In particular, we will detect histopathological features associated with the increased aggressiveness of supra-carcinoids and other molecular sub-types we have previously identified. **Methods:** A unique series of >300 whole-slides images, enriched for atypical carcinoids, will be analysed through computer vision techniques. The convolutional neural networks will have to overcome different challenges; namely, a limited sample size with complex features hardly detectable even by expert pathologists. Data augmentation, image generation and few-shots learnings techniques will be explored to overcome these challenges. **Expected results:** The deep learnings models will help unveiling the histopathological features of pulmonary carcinoids associated with the increased aggressiveness of these tumors observed in a subset of patients. Integrating the molecular and morphological data will also shed light on the etiology of these diseases, and inform/improve their diagnosis, classification, and clinical management.

Primary authors: MATHIAN, Emilie; FOLL, Matthieu (IARC)

Presenter: MATHIAN, Emilie

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