

Semiautomated workflow for tissue-microarray analysis on tumors of the central nervous system

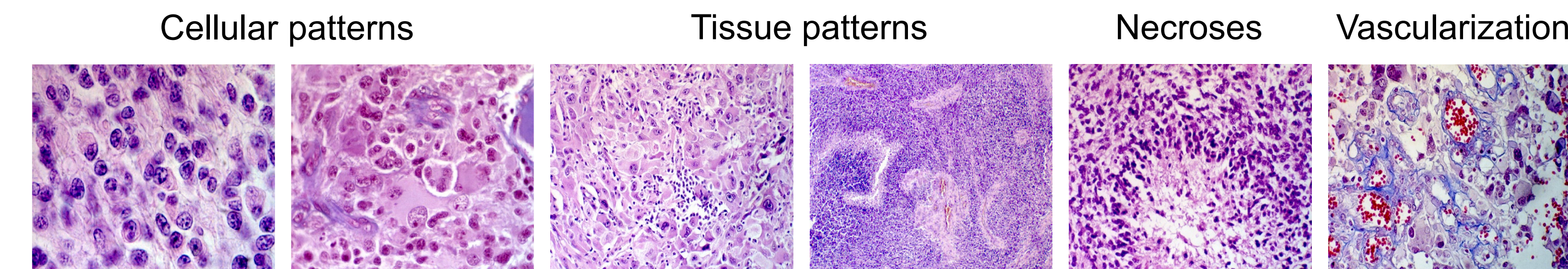
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INTRODUCTION

Meningiomas are the most common primary intracranial neoplasms. They are classified into 3 grades of aggressiveness but even benign meningiomas also recur in up to 30% of the cases. Their diagnosis relies on well-established histological criteria but it suffers from inter-observer variability and lack of quantitative information. The use of state-of-the-art methodologies for automated image analysis combined with data science approaches in large series of samples may provide new markers for decision support systems in the management of these tumors. In this work we try to analysis nuclear parameters in a set of samples diagnosed as meningioma in HCUV, included in tissue microarrays and stained by hematoxylin-eosin standard procedures.

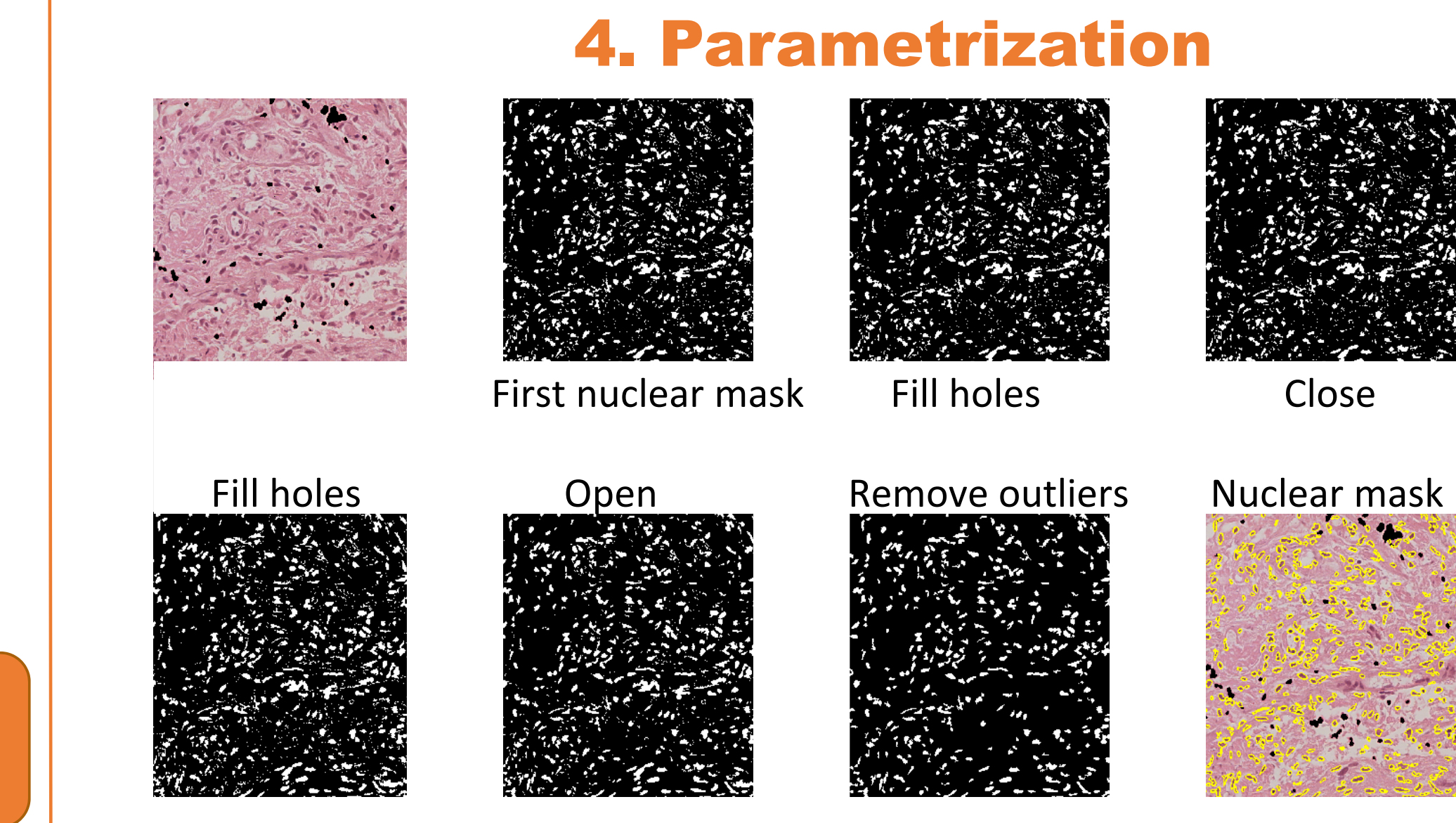
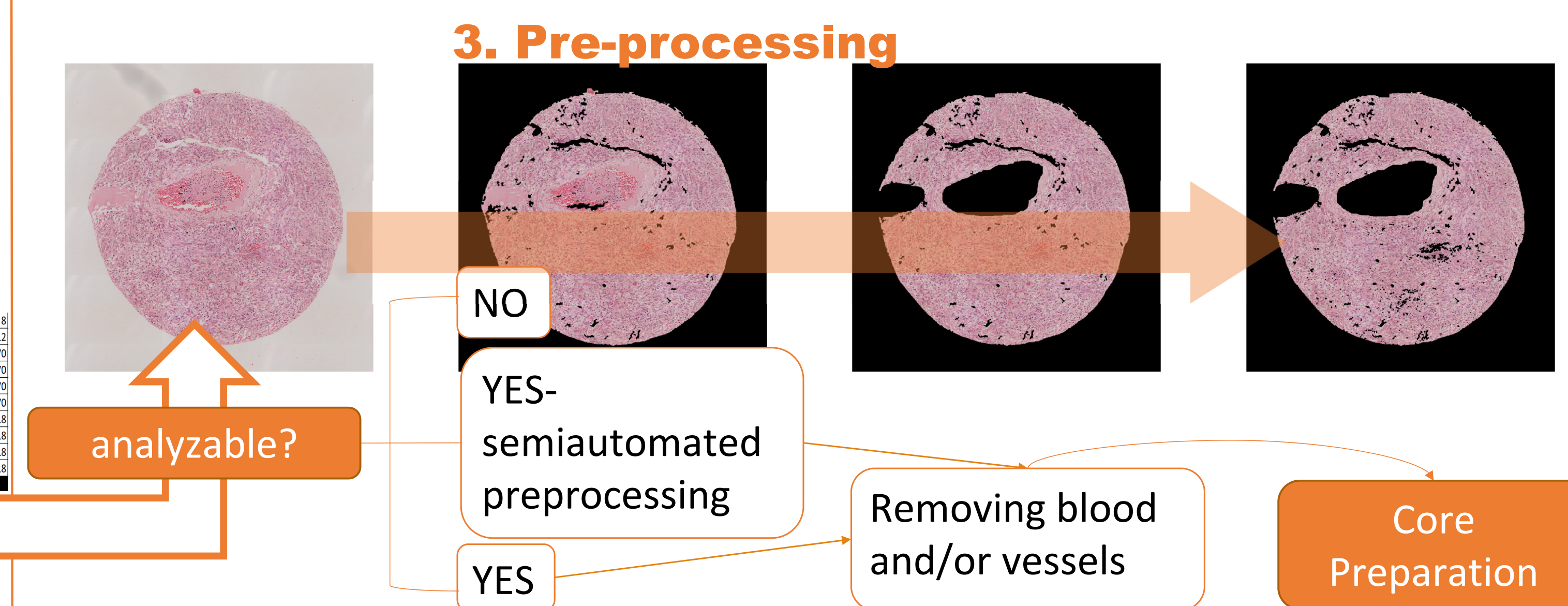
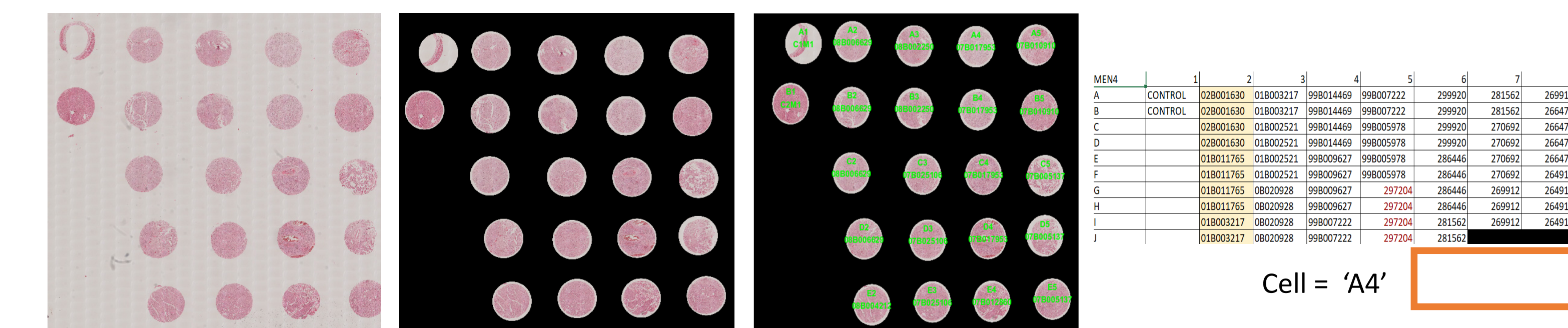
Histopathological characterization



MATERIAL AND METHODS. We used Matlab for image procedures and R for statistical analysis in a total of 144 cores of tissue samples.

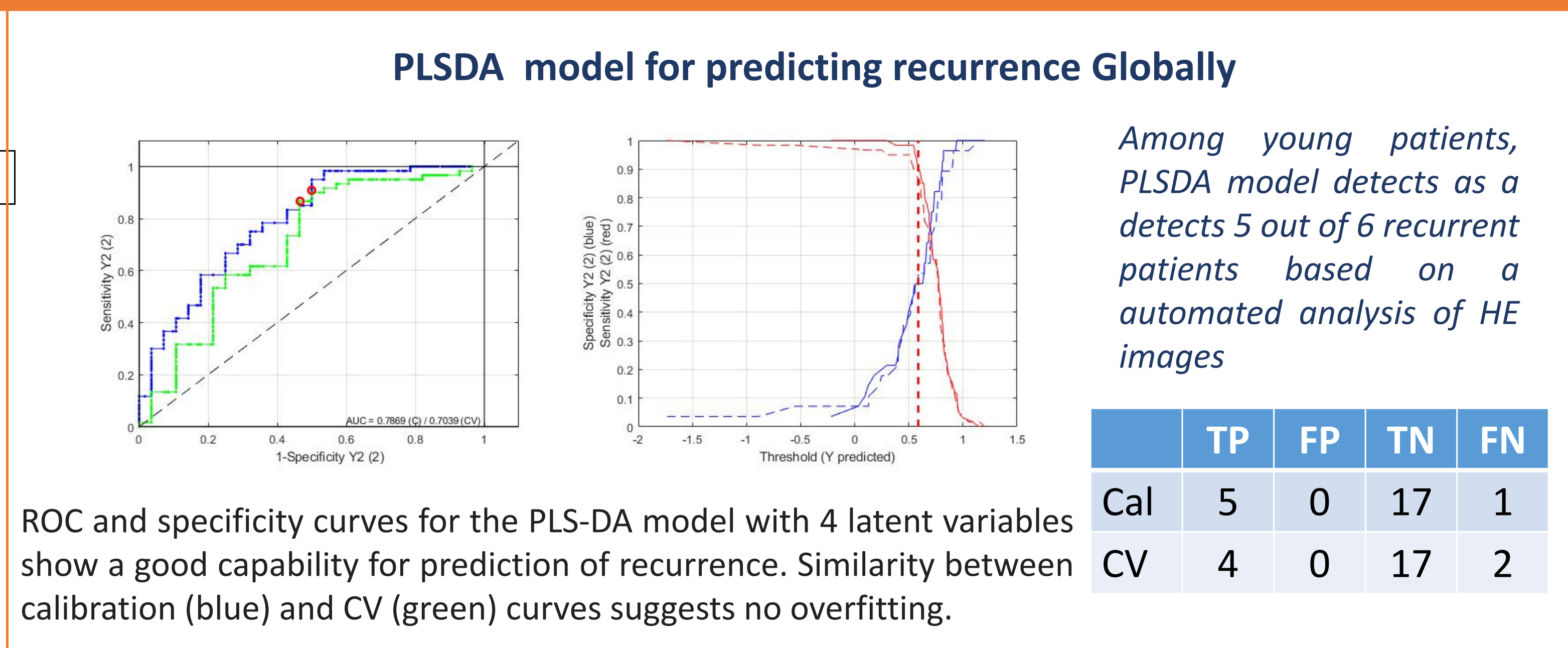
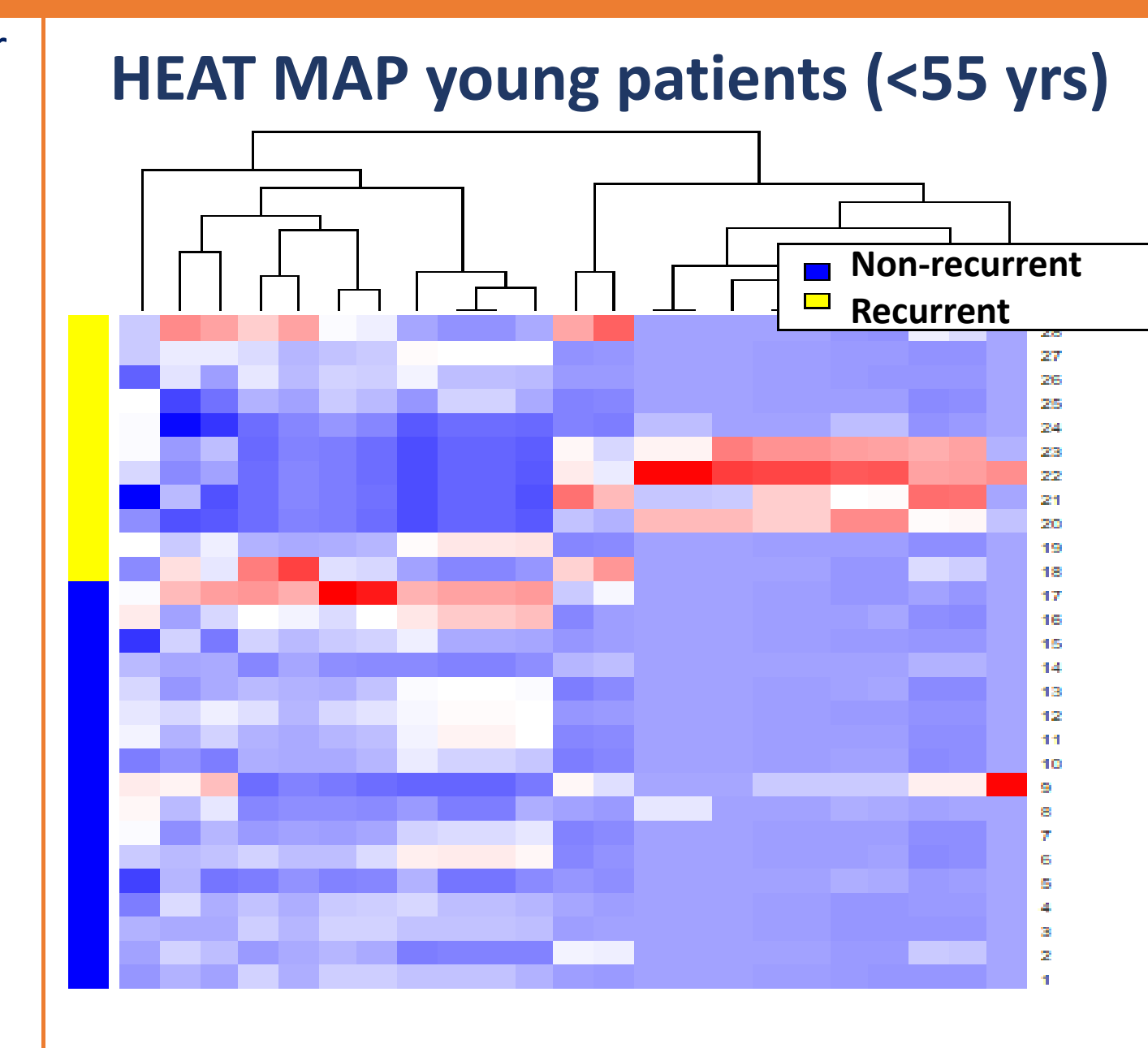
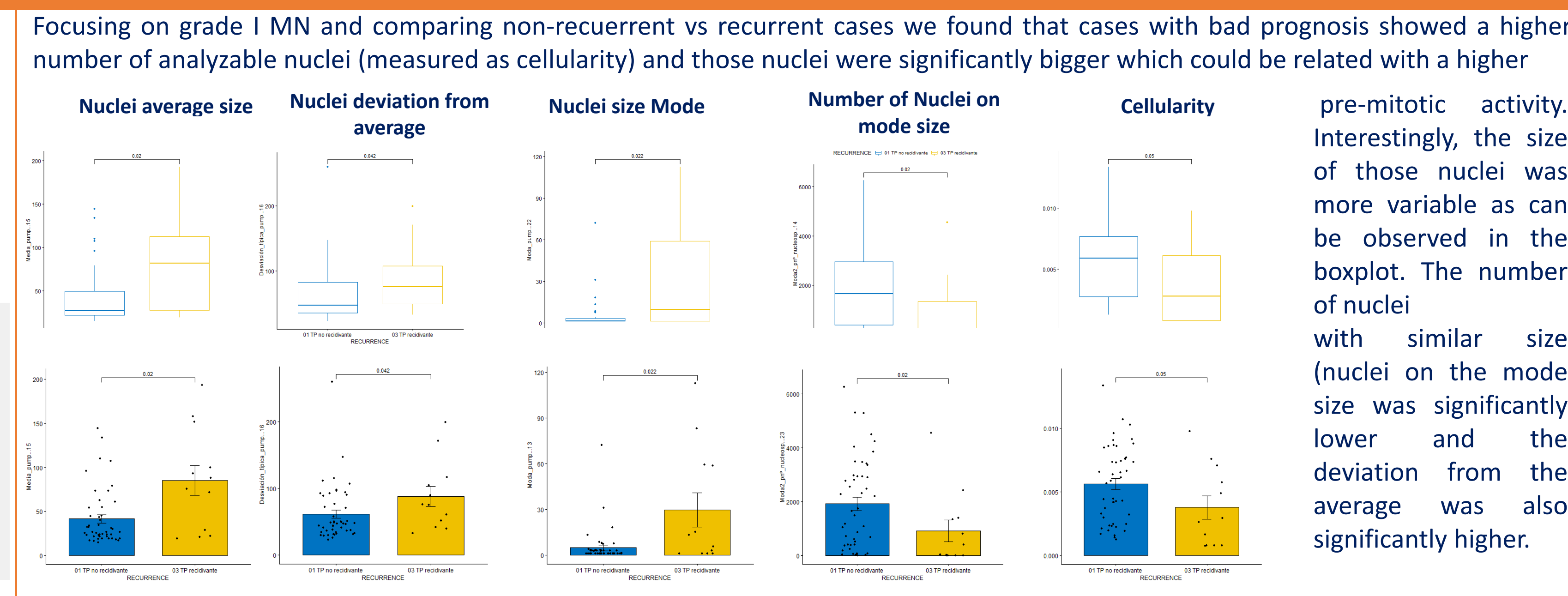
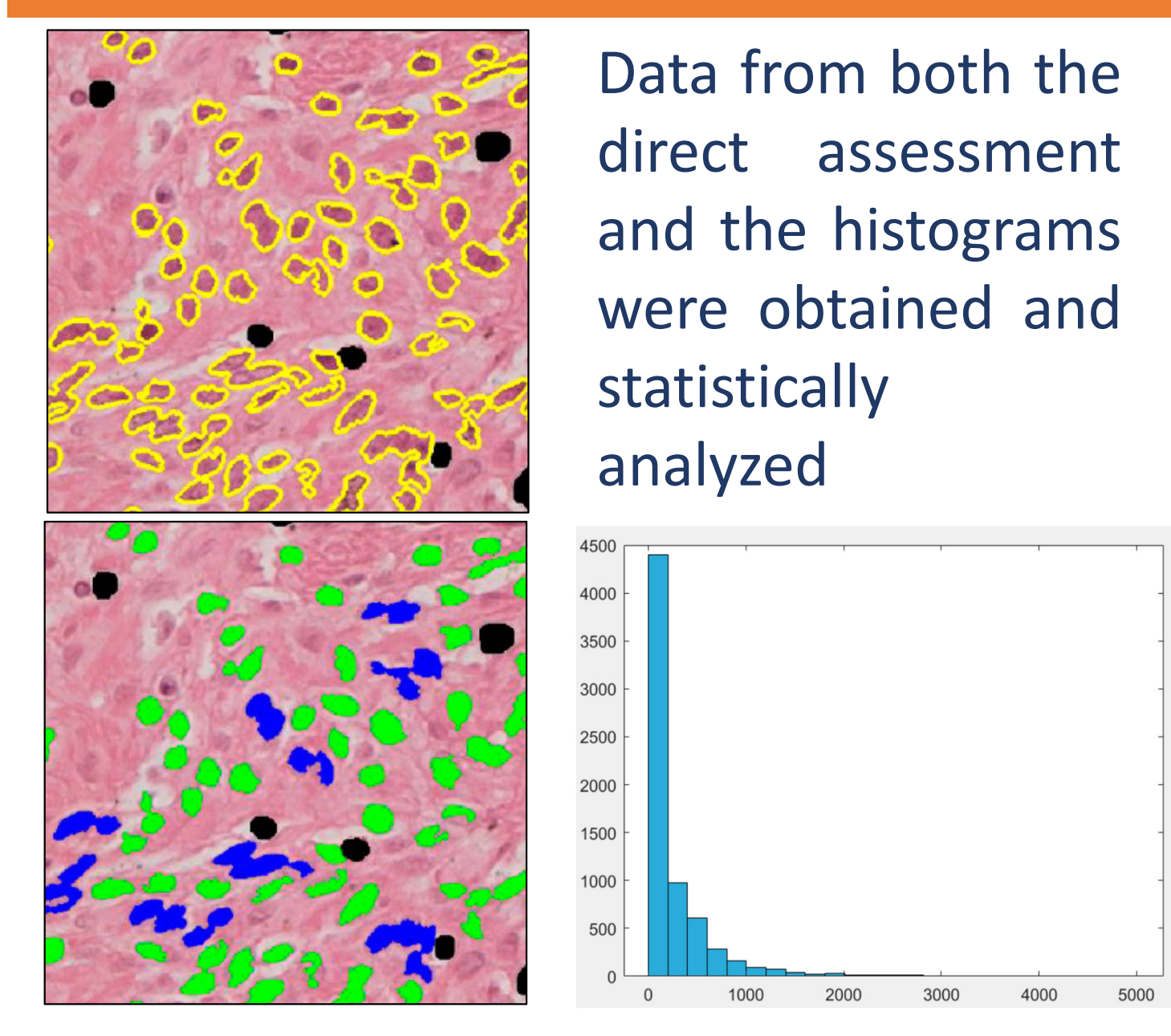
Clinical Data. From the total, 116 samples were diagnosed as grade I and 24 as grade II. 70,8% were females and 29,2% males. A 67,4% did not recur in a period of at least 5 years of follow up while 18,8% recurred before 3 years and 13,932,6% recurred after that period.

1- Removing background 2. Automated Sample Identification



NUCLEAR ANALYSIS
Total Area, total number, nuclear area, cellularity
HISTOGRAM ANALYSIS
Nuclei moda, nr. of nuclei on moda, average, standard deviation and ratios.
DATA ANALYSIS
Z-scores, PCA, PLS_DA models, univariate comparisons

RESULTS. 68 samples provided an analyzable core and were evaluated.



CONCLUSIONS

- Different parameters that characterize the homogeneity in the nuclear size indicate that a higher variability is associated with a worst outcome in histologically comparable meningiomas with non-supervised measurements and suggest that additional morphological parameters could be of interest.
- The risk-prediction for young meningioma patients could be enhanced through automated image analysis. Deeper and further studies are necessary to corroborate this data but the preliminary results are promising.
- Our results suggest that the semiautomated analysis of whole digitalized slides from TMAs combined with multivariate predictors may help in the decision-making process in the management of meningioma.