Classification of Pancreatic Cysts in Computed Tomography Images Using a Random Forest and Convolutional Neural Network Ensemble

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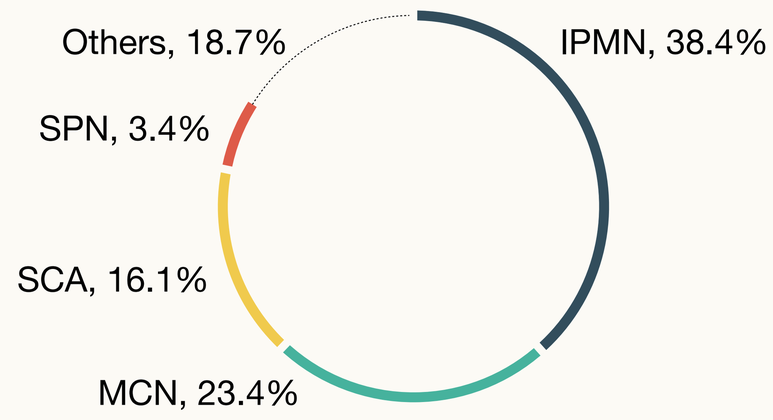
Introduction

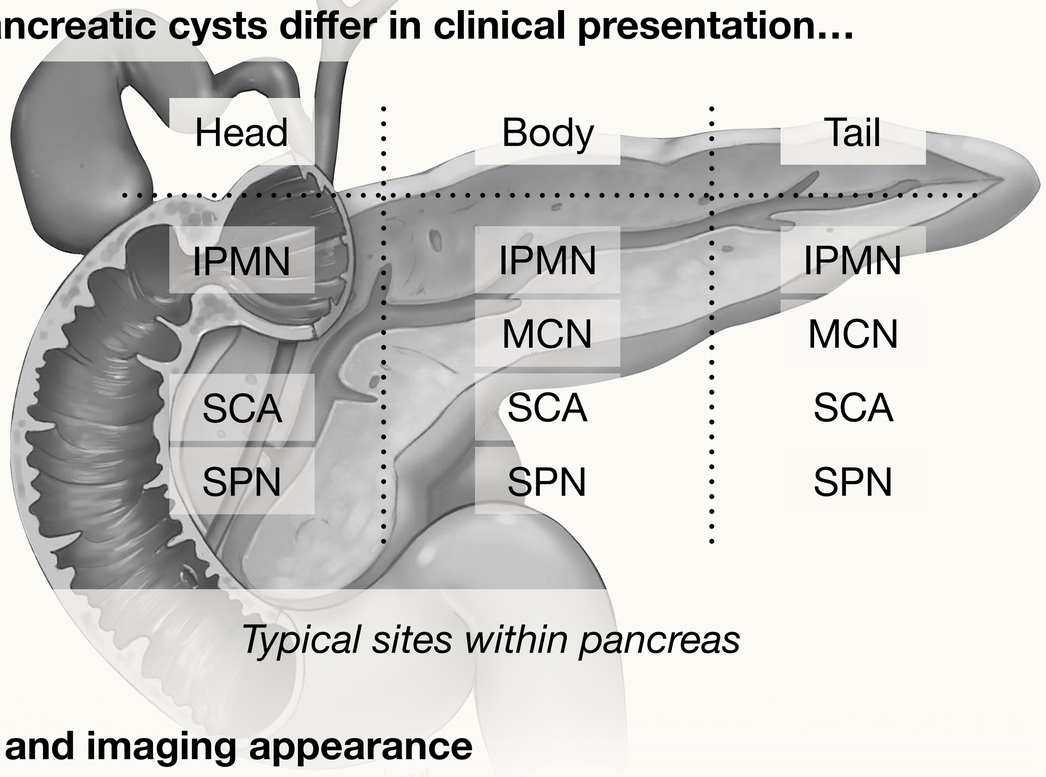
Intraductal Papillary Mucinous Neoplasms (**IPMN**s) and Mucinous Cystic Neoplasms (**MCN**s) are considered the precursors of pancreatic cancer, one of the most lethal of all cancers with a 5-year survival rate of 9%. Other pancreatic cysts range from completely benign, such as Serous Cystadenomas (**SCA**s) to cysts with malignant potential, such as Solid-Pseudopapillary Neoplasms (**SPN**s). Early correct identification ensures appropriate management.

Due to their mostly inconspicuous nature, the majority of pancreatic cysts are discovered incidentally on CT scans. We present a non-invasive method for discriminating pancreatic cysts.

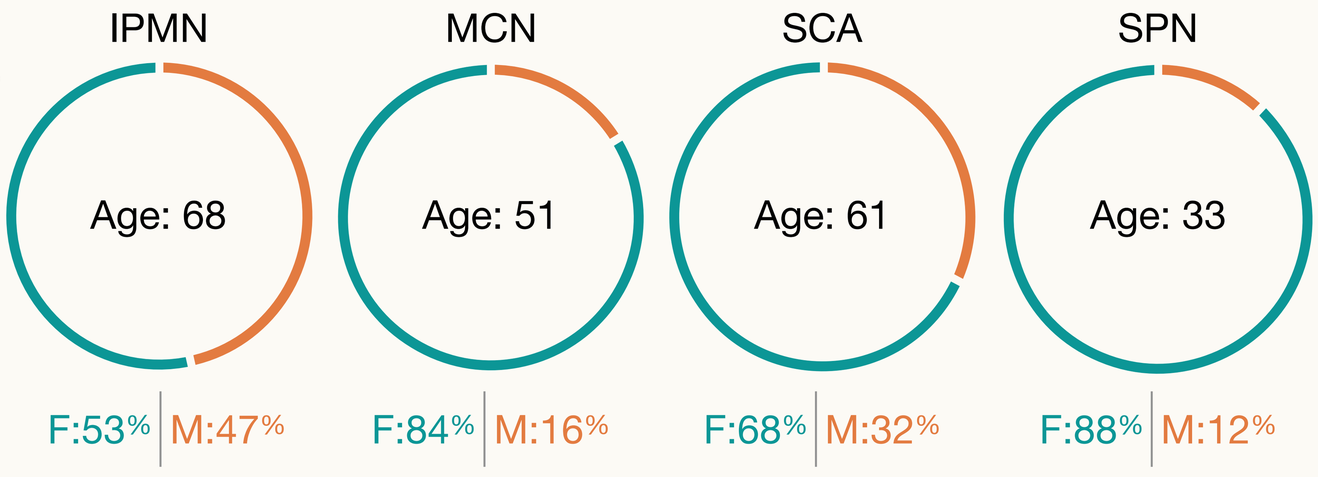


Average distribution of most common pancreatic cysts in population

Pancreatic cysts differ in clinical presentation…

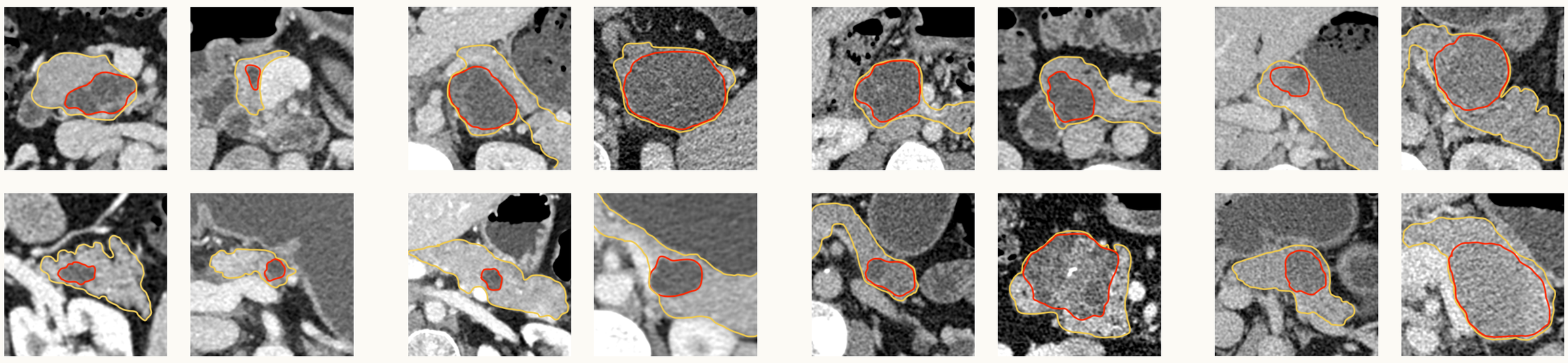


Typical sites within pancreas



Average gender distribution and mean age

… and imaging appearance

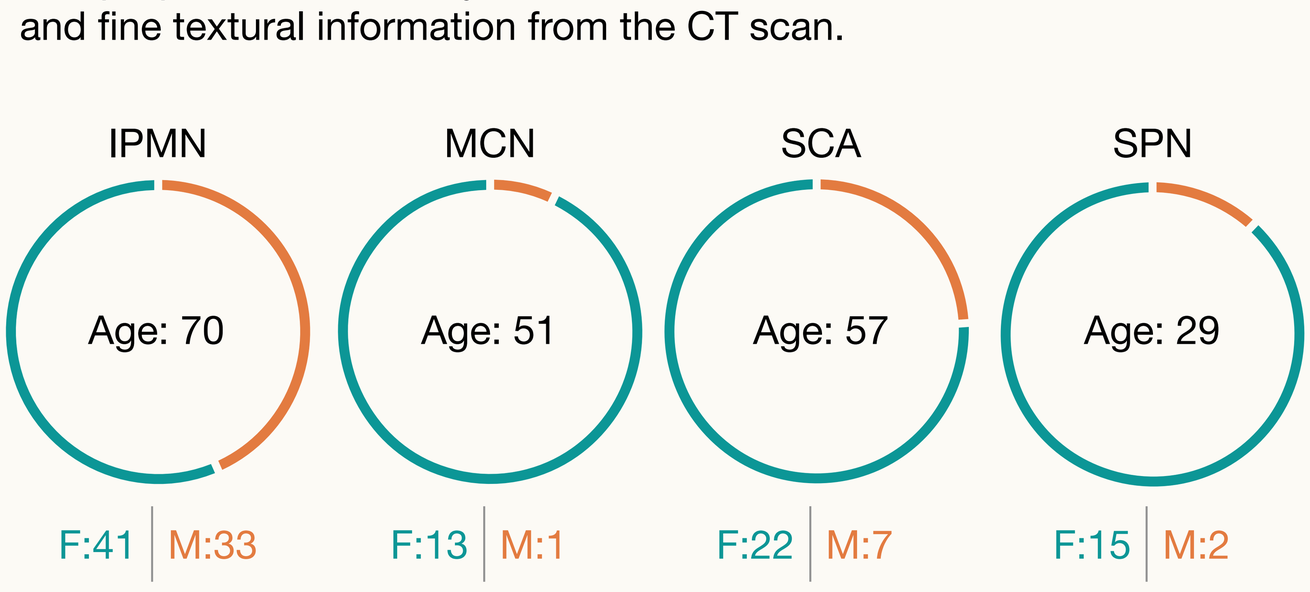


Examples of pancreatic cysts (red) within pancreas (yellow) in CT scans

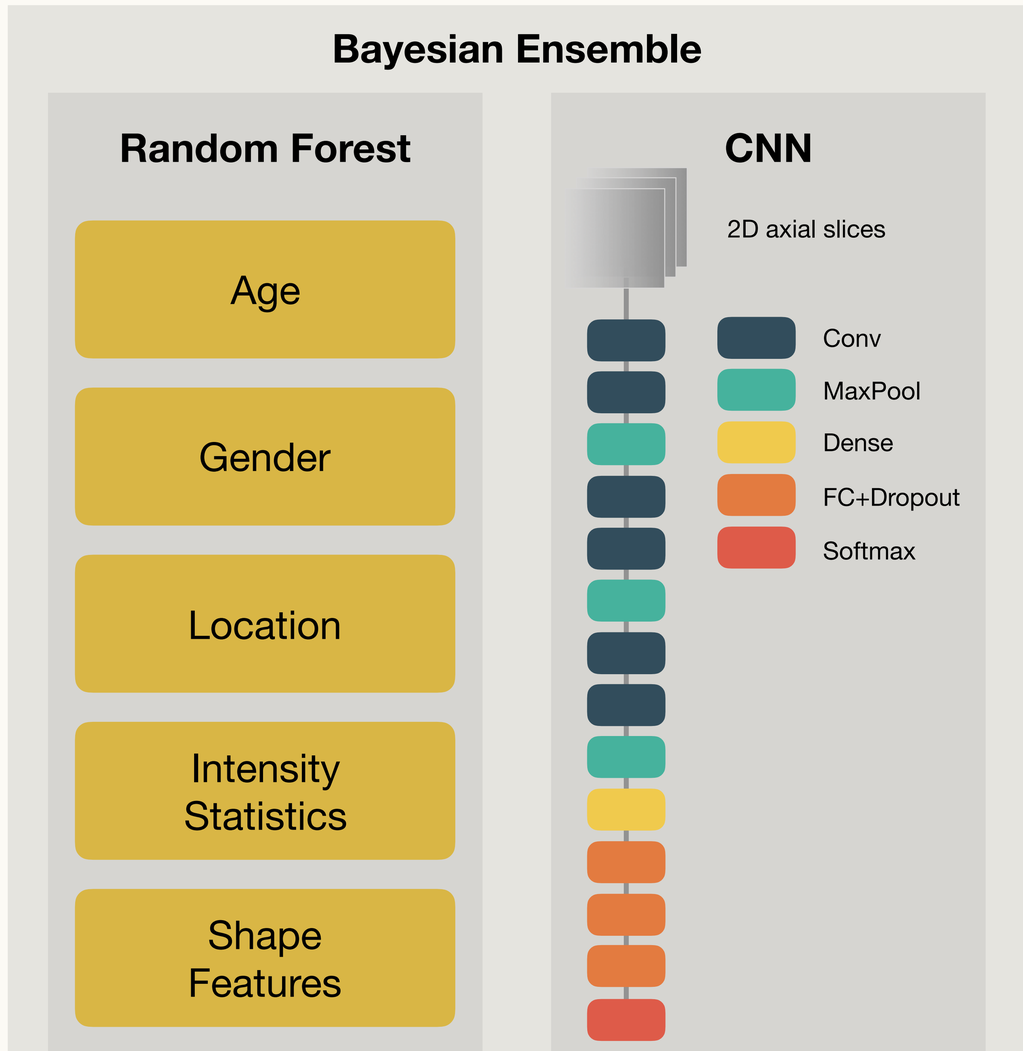
However, the clinical and imaging features overlap, and it is often difficult to make a correct diagnosis.

Method

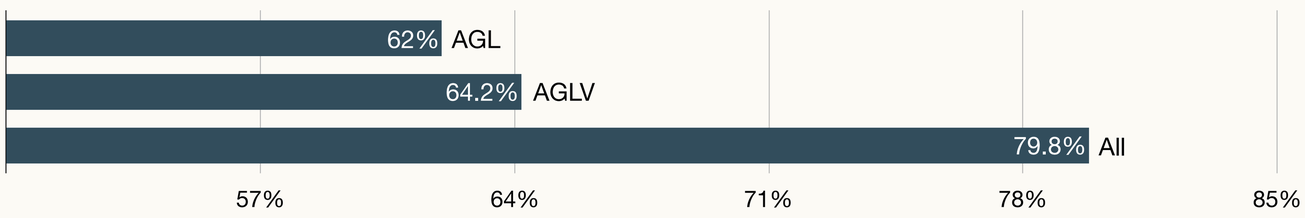
We propose to use a Bayesian combination of a Random Forest and a Convolutional Neural Network to analyze both clinical information and fine textural information from the CT scan.



Gender distribution and mean age in our dataset

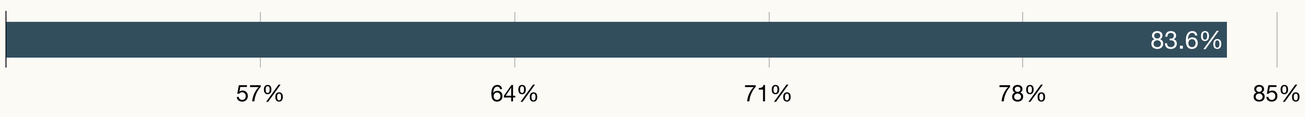


Results

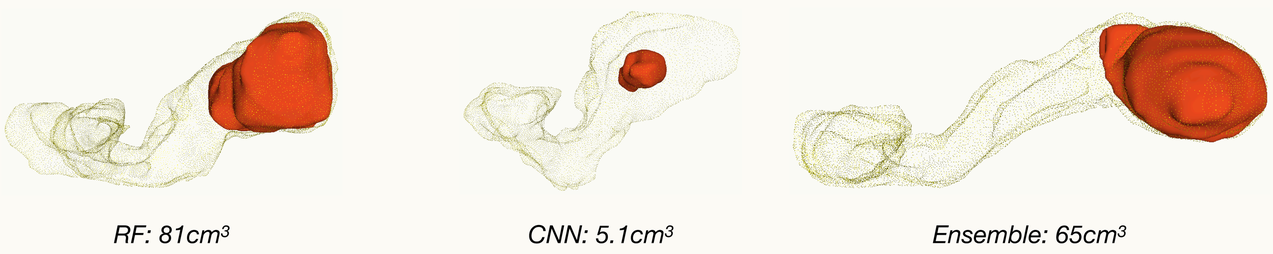


Accuracy of RF trained on different features (A - age; G - gender; L - location; V - volume)

Accuracy of CNN with and without the augmentation routine



Accuracy of the RF and CNN ensemble



RF: 81cm³ *CNN: 5.1cm³* *Ensemble: 65cm³*

3D examples and average volume of misclassified cysts (red) within pancreata (yellow)

Confusion matrix of the ensemble

Ground Truth	Ensemble Prediction (%)			
	IPMN	*MCN*	*SCA*	*SPN*
IPMN	95.9	1.4	1.4	1.4
MCN	14.3	64.3	21.4	0.0
SCA	34.5	3.5	51.7	10.3
SPN	0.0	0.0	0.0	100.0

Acknowledgements

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