AN AUTOMATIC COLORECTAL POLYPS DETECTION APPROACH FOR CT COLONOGRAPHY

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ABSTRACT

- We propose an automatic colorectal polyps detection approach that has two cascade stages

- In the first stage, a CNN model is trained to detect polyps in the segmented colon wall CT.

- To reduce the false positives generated by the detector, the second stage classifier is deployed to exploit the different views of the CT scans (axial, sagittal, and coronal).

- The approach successfully identified polyps after the classification stage with an AUC ~ 98.6%.

PROPOSED APPROACH

- As shown in the figure, given an axial CT slice, we segment the colon to reduce any dispensable information from other tissues.
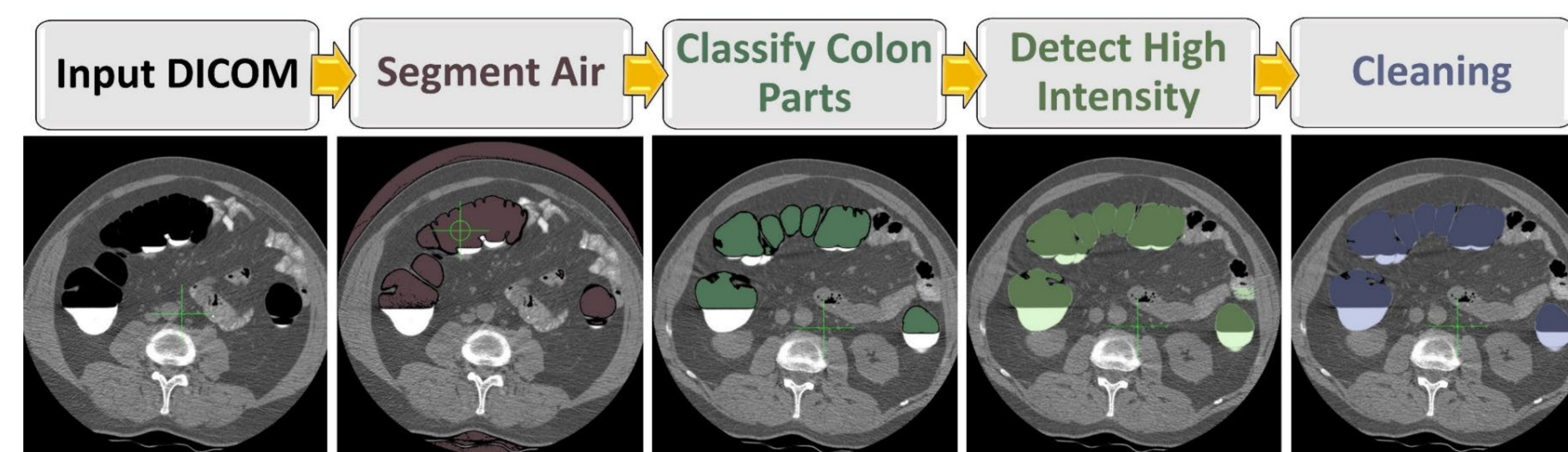

- Then the segmented colon regions are fed into YOLO-based detector to localize polyp candidates.
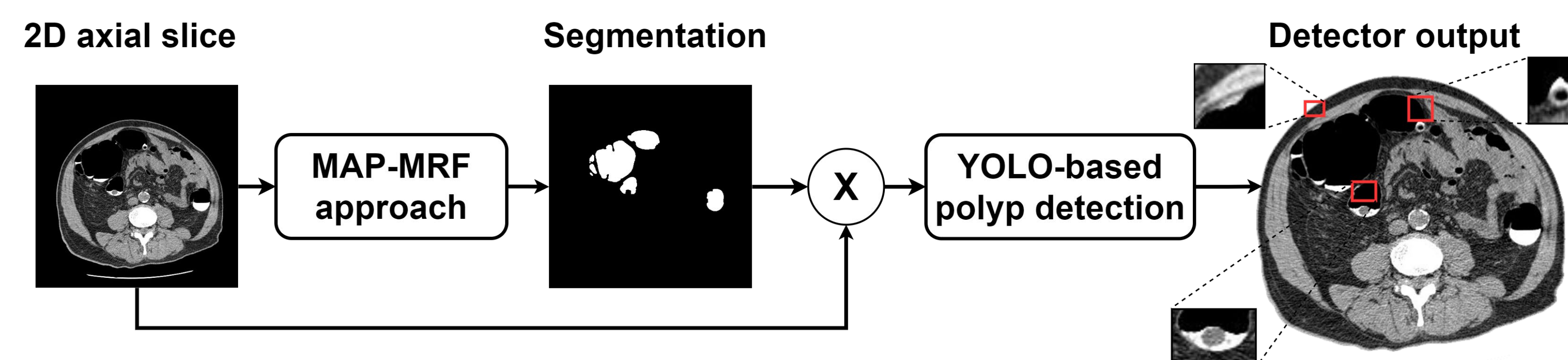
- To remove the false positives, we exploited other views of the DICOM (i.e., sagittal and coronal views), based on that, most polyps should appear in the three views as a small protruding mound, unlike non-polyp regions as shown in the figure.
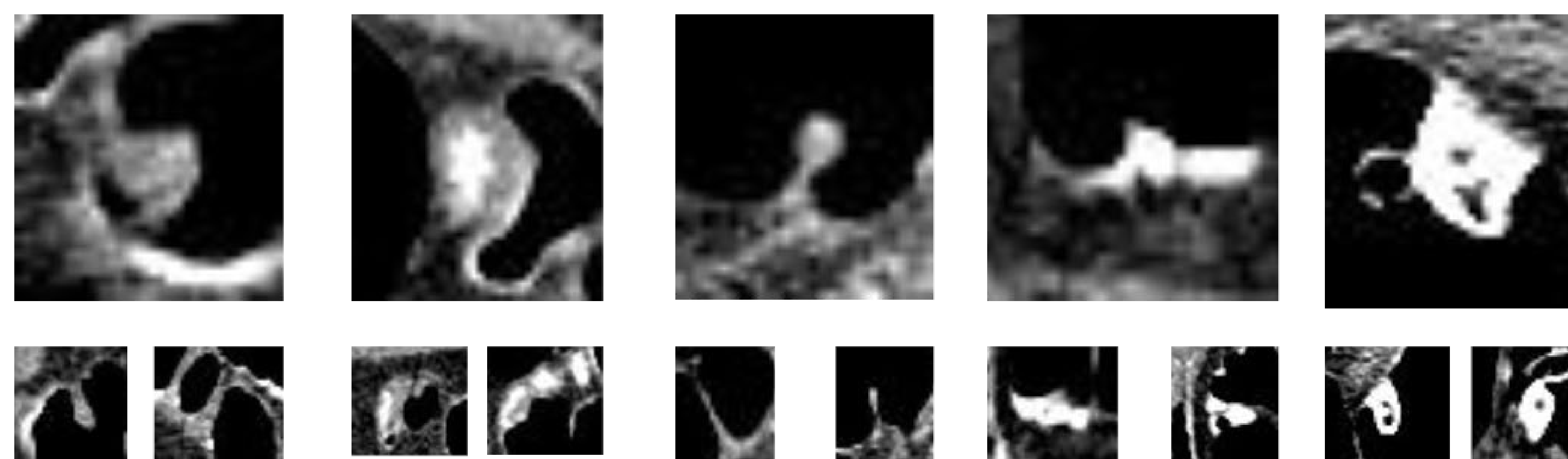
- Our proposed classifier avoids the drawbacks of using a 3D CNN, instead, it uses 2D CNN to extract features from the three 2D views of each polyp candidate.
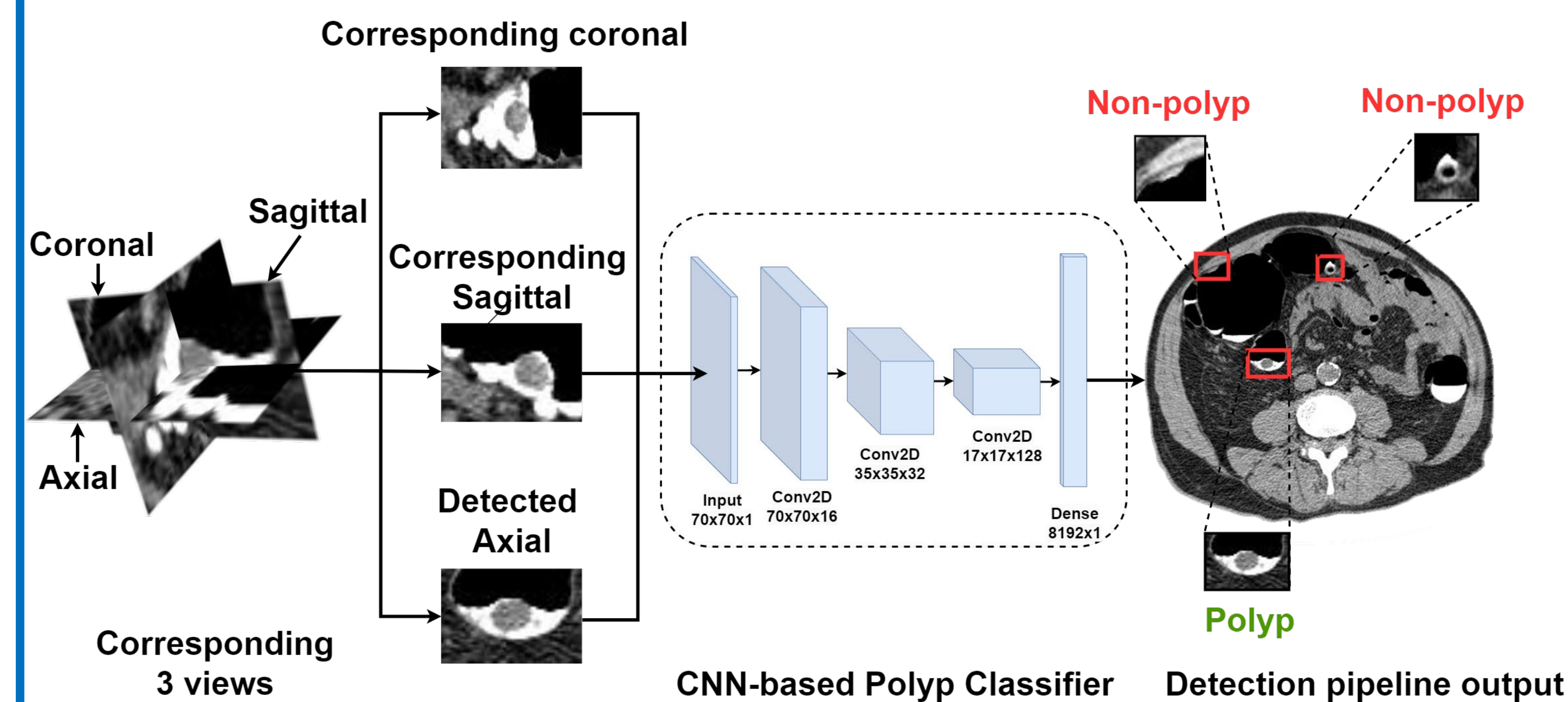

EXPERIMENTAL RESULTS

- We conducted our experiments on a dataset that consists of CT scans for 49 patients.

- The scans have 59 annotated polyps of size ≥ 6 mm.

Table 1. The results of the detection stage.

Model	Parameters	Sensitivity	mAP
YOLO-V5 only	7,050,500	44.4 %	43.5 %
YOLO-V5 + Seg.	7,050,500	86.67 %	79.7 %
YOLO-V7 + Seg.	36,481,772	88.05%	85.7 %

Table 2. The results of the classification stage.

Model	Parameters	Sensitivity	AUC
2D CNN	173, 202	94.80%	98.59%
3D CNN	1,296,577	87.80%	93.52%
Depthwise CONV.	399,314	84.73%	90.14%
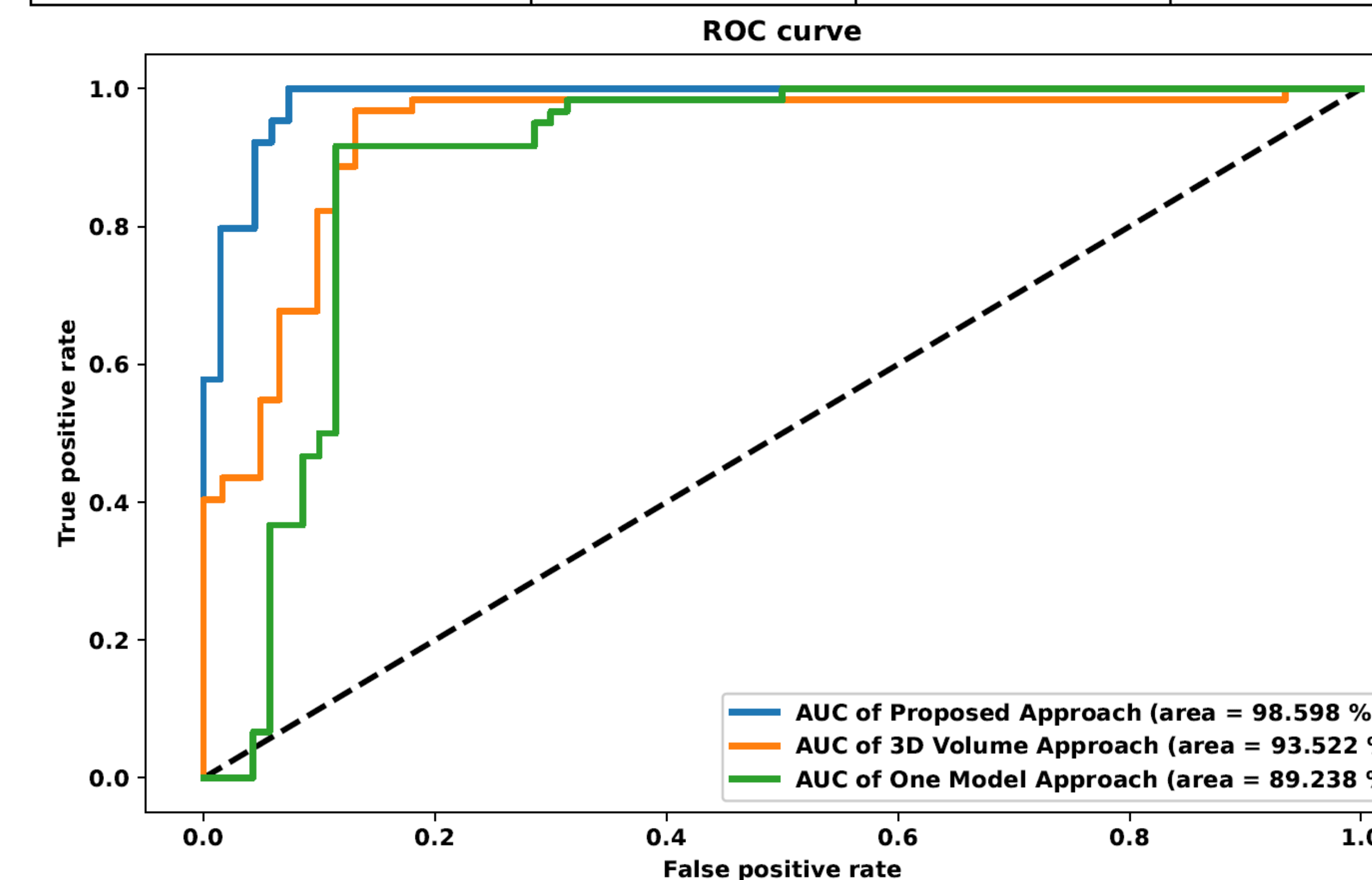
CONCLUSION

- We developed an CNN-based detector, which was guided by changing its effective receptive field using a segmented colon.

- The detection results is refined using a classifier, which exploits the different views of the CT scan.

- The high-performance, AUC of 98.6%, encourages radiologists to use the proposed approach for reading CT scans.