



AUTOMATIC DETECTION OF BLOOD AND HEMATIC RESIDUES IN THE ENTERIC LUMEN USING A CONVOLUTIONAL NEURAL NETWORK

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Introduction

- Capsule endoscopy (CE) has revolutionized the approach to patients with suspected small bowel disease
 - First line approach to patients with obscure gastrointestinal bleeding
 - Allows non-invasive full-length inspection of small intestinal mucosa

HOWEVER

- Revision of CE images is a time-consuming task and prone to error
- Artificial intelligence, and particularly, convolutional neural networks (CNN), have demonstrated high performance levels for image analysis.

WE AIMED TO CREATE A CNN MODEL FOR AUTOMATIC DETECTION OF BLOOD OR HEMATIC RESIDUES WITHIN THE ENTERIC LUMEN IN CE IMAGES.

Methods

- 1 483 CE exams performed between 2015 and 2020
 - Extraction of 22 095 images
 - Image labelling by two gastroenterologists with experience in CE
- Development, training and testing of a CNN model
- For each image, the CNN estimated the probability of hematic content for each image

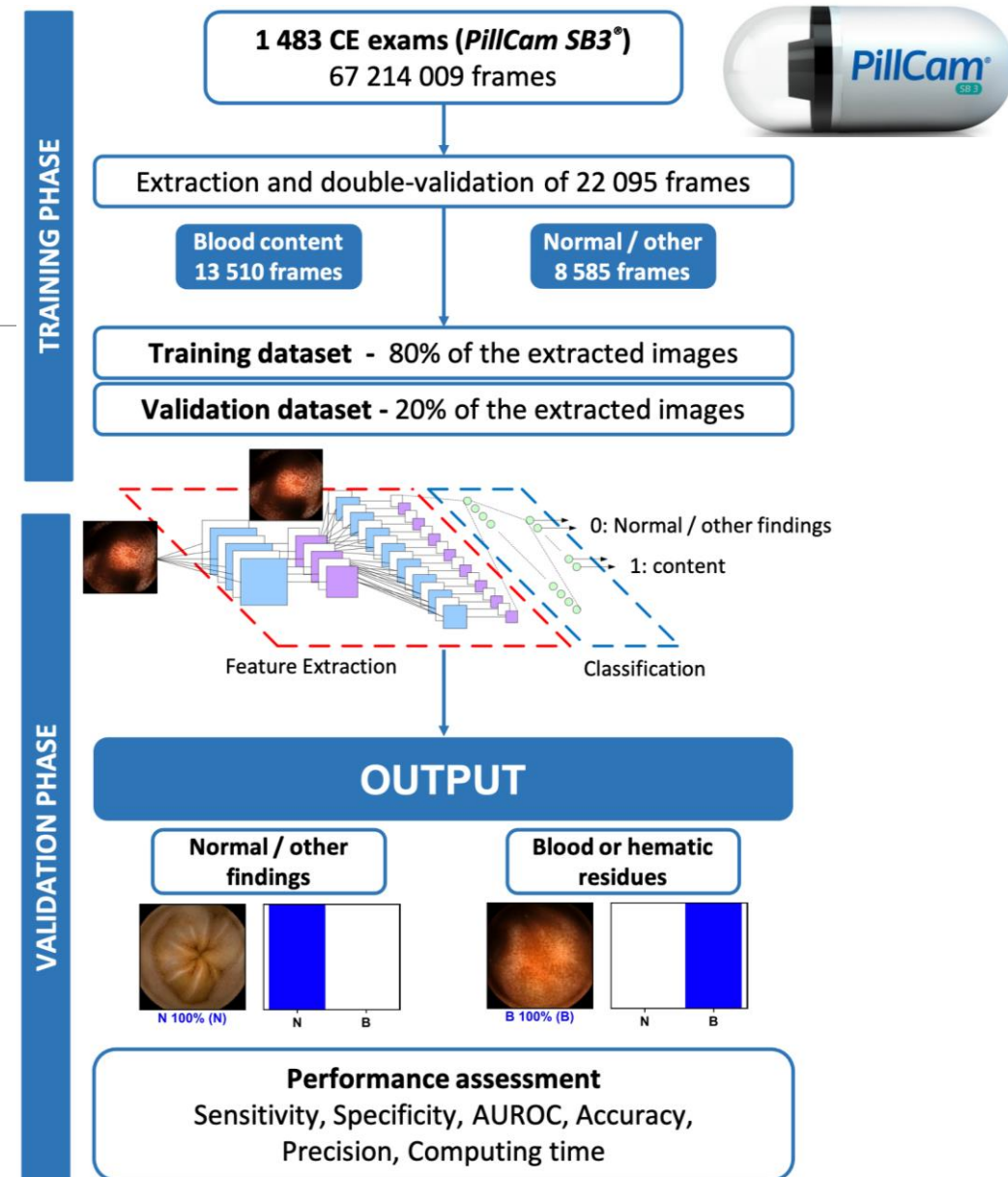


Figure 1 – Study flowchart

Results

- Our model demonstrated **high performance levels** for the detection of blood or hematic residues:
 - Sensitivity: 98.6%
 - Specificity: 98.9%
 - Accuracy: 98.5%
 - Precision: 98.7%
 - Area under the ROC curve: 1.00
- The analysis of the testing dataset required **24 seconds**
 - Image processing rate: 184 frames/s

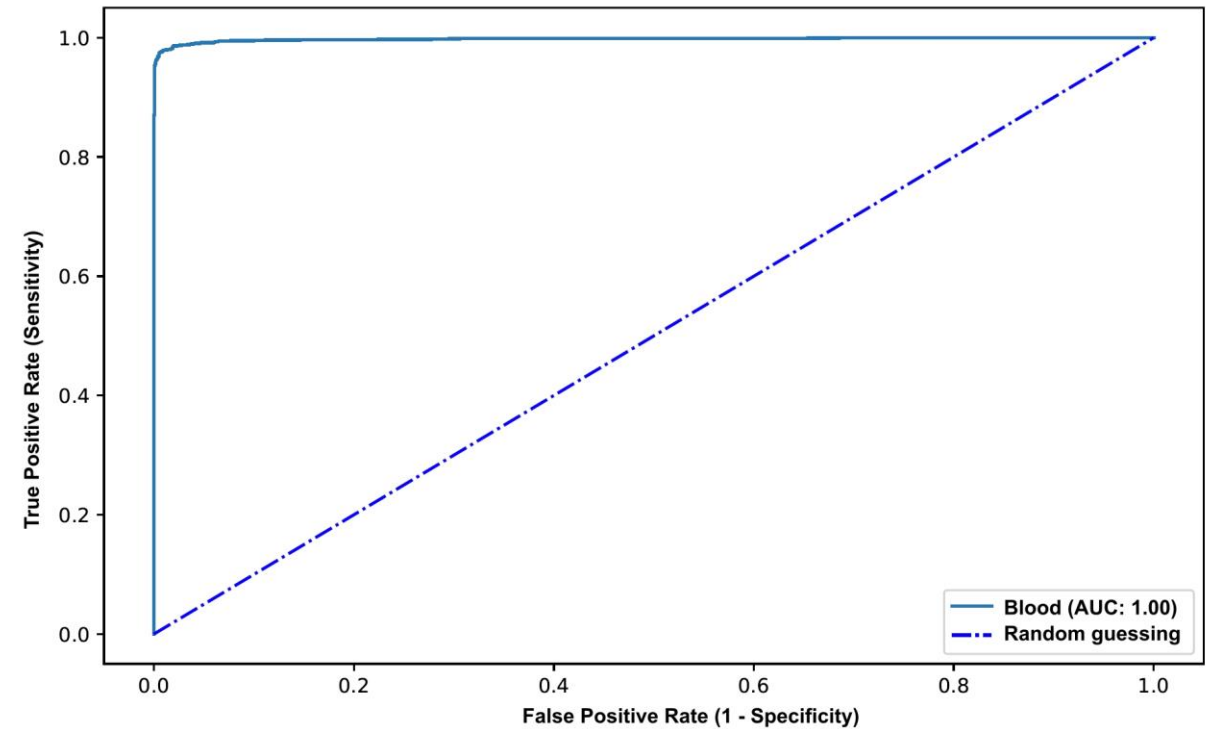


Figure 2 – ROC curve and respective area under the ROC curve (AUC) for the detection of blood or hematic residues by the CNN model

Conclusions

- We have developed a *deep learning* CNN capable of accurately detecting blood content in CE images
 - Particularly useful in acute contexts where prompt detection of the hemorrhagic foci is essential.
- AI tools must be regarded as supportive rather than substitutive of conventional CE reading. **This technology may boost the efficiency of CE exams:**
 - Improving CE diagnostic accuracy.
 - Mitigating the risk of missing lesions.
 - Reducing CE reading times.
 - Lessening the burden on gastroenterologists.