# Multi-task learning for automated recess detection and distension classification in hemophilic patients

Ph.D. Marco Colussi
Department of Computer Science
University of Milan
marco.colussi@unimi.it
https://warpcut.github.io/

Introduction

- Context: Hemophilic patients often suffer from **joint bleeding (hemartrosis)**, which causes **distension** and can result in serious conditions like hemophilic arthropathy.
- Problem: **Lack** of an automated system for detecting and diagnosing joint bleeding using ultrasound imaging.
- Idea: A **CAD** system to **detect** and **diagnose** distension could significantly improve patient outcomes.

Not distended   *Distended*
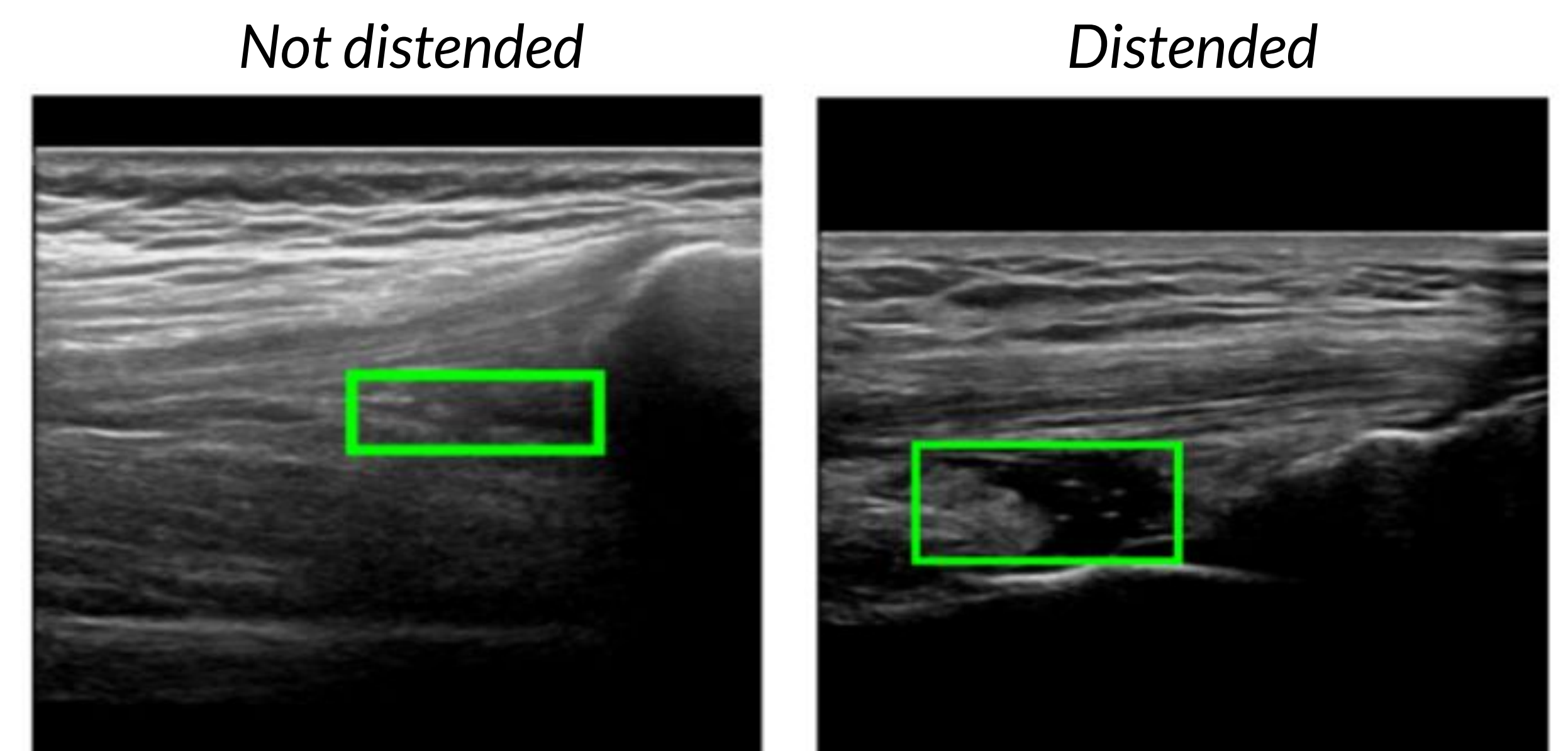
## Methodology

MTL Architecture
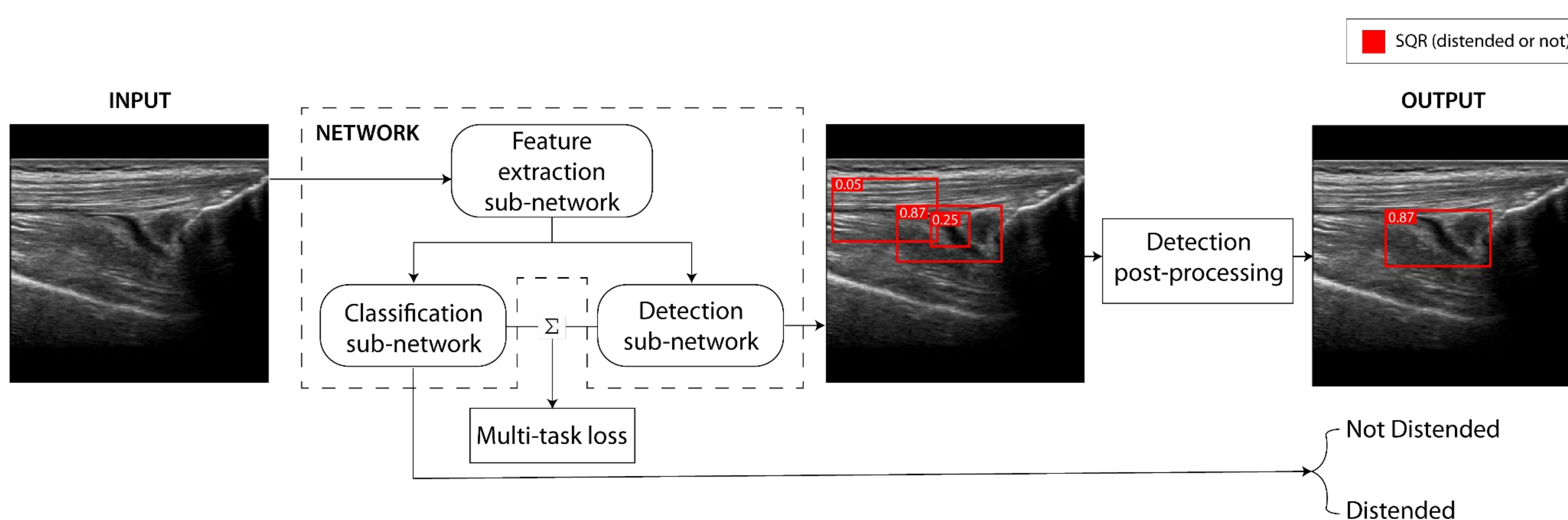
- Data acquisition: **483 SQR longitudinal** scan ultrasound images of 208 adult patients
- Detection approach: **one-stage object detection** to identify both distended and non-distended recesses
- Multi-task approach: **single-class object detection** branch (identifying the recess) and **classification branch**, classifying the distension.
- Evaluation: 5-fold cross-validation

Results

- Both solutions achieve an IoU > 0.5 in more than **82%** of the cases.
- MTL achieves a **sensitivity of 77%** using an excerpt of 27 images of **hemartrosis**.

	Balanced accuracy	Specificity	Sensitivity	IoU
Classification baseline	0.73 ± 0.03	0.85 ±0.09	0.61 ± 0.13	-
Detection baseline	-	-	-	**0.66 ± 0.02**
Detection Approach	0.74 ± 0.07	**0.97 ±0.03**	0.52 ± 0.12	**0.66 ± 0.01***
Multi-task Approach	**0.78 ± 0.05**	0.92 ± 0.04	**0.64 ± 0.09**	0.63 ± 0.02

Example of detection
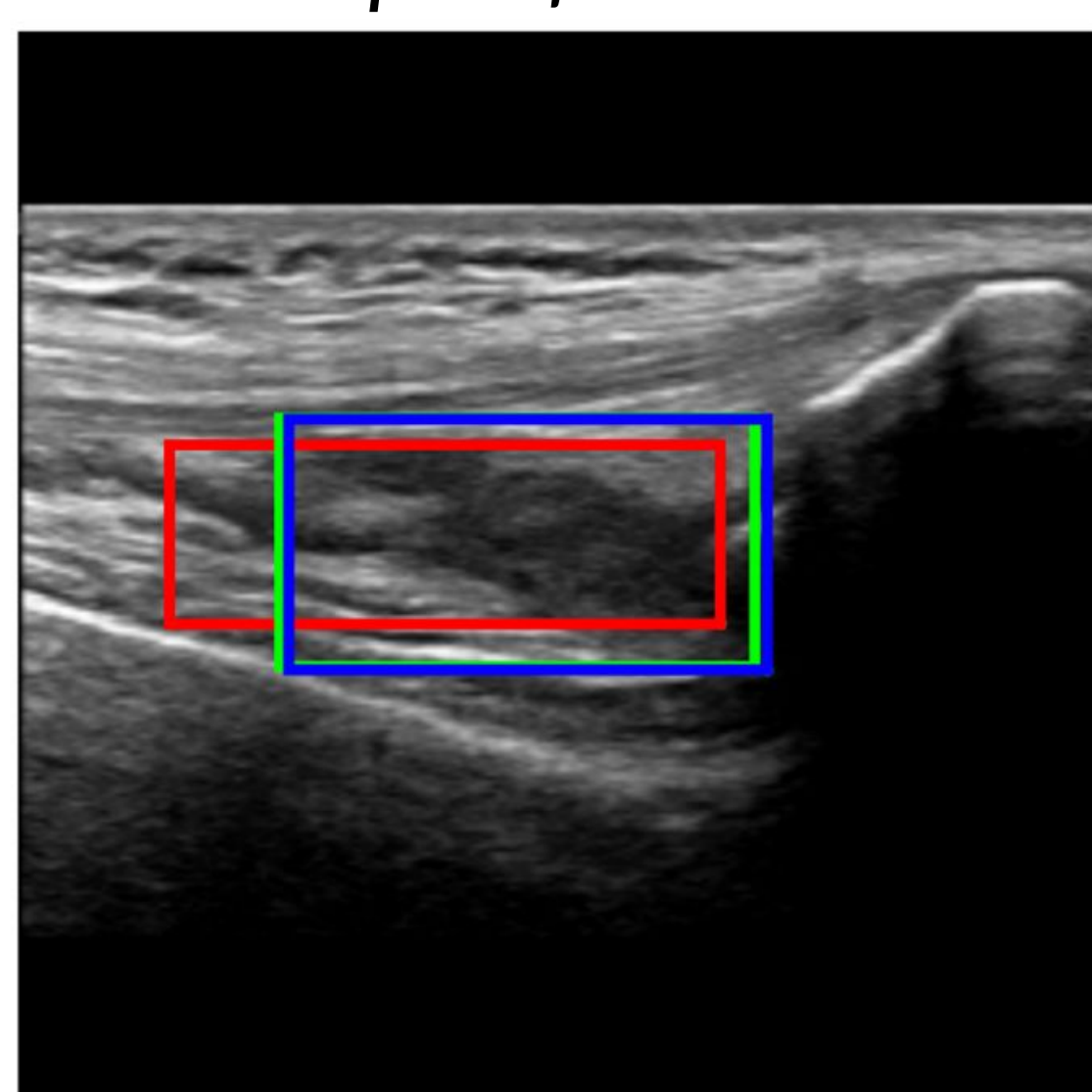
Conclusion

- Automated system shows **potential to assist diagnosis** of joint bleeding in hemophilia patients.
- Future work could **improve** model's **specificity**, extend to **other articulations**, and differentiate the cause of distension, such as **hemarthrosis**.
- Adopt US **videos** and combine **different scans**.
- Due to the unbalanced data explore **anomaly detection**

UNIVERSITÀ DEGLI STUDI DI MILANO

EveryWareLab

Reference: Colussi, M., Civitarese, G., Ahmetovic, D., Bettini, C., Gualtierotti, R., Peyvandi, F., & Mascetti, S. (2023). Ultrasound Detection of Subquadricipital Recess Distension. Intelligent Systems with Applications, 200183.

Scan me for full text