TexSpread360: A Modular System for AI-Based Automated Sorting of Post-Consumer Textiles for Reuse and Recycling

Martin Kohnle*†[1], Julian Schanz*[1], Alexandra Teynor[1], Sebastian Geldhäuser[1,2], and Mesut Cetin[1,2]

[1]Technische Hochschule Augsburg [Deutschland] = Augsburg University of Applied Sciences [Germany] – Germany
[2]Institut für Textiltechnik Augsburg – Germany

Abstract

Used textiles are one of Europe's fastest-growing waste streams, and since January 2025 the revised EU Waste Framework
Directive mandates their separate collection across the EU. Reusing or recycling them at scale, however, still hinges on manual,

labour-intensive sorting, the central bottleneck of textile circularity. TexSpread360 develops a modular automated

sorting system that couples mechanical handling (robotic singulation, a free-fall stage, a spreading/imaging stage) with multimodal

perception (RGB, NIR) to route each garment to reuse or recycling.

As a first result, we derive the system's requirements from industrial sorting practice: a process-oriented view (functional needs and sorting logic)

and a technical-formal view (classification, robotic handling, system integration) are consolidated into a single set of requirements. From this we

obtain a staged sorting architecture in which the reuse-versus-recycling decision is distributed across stages: a coarse, fast pre-decision during

free fall (early defect rejection) and a rich, accurate decision during spreading. This exposes an explicit throughput-versus-accuracy trade-off that

motivates our core research direction.

The research focus is the visual classification and decision layer: (i) 360◦ multi-view fusion for robust recognition

*Speaker
†Corresponding author: Martin.Kohnle@ita-augsburg.de

under uncontrolled pose and motion, (ii) multimodal integration of RGB, NIR and hyperspectral cues, and (iii) an adaptive, uncertainty-aware inference

strategy that, per item, commits, requests additional sensing, or defers, rather than treating every garment as equally easy. The poster presents the

requirements-driven system architecture, the distributed decision concept, and the planned validation on real post-consumer material, illustrating
how AI-driven perception and modular automation can close a critical gap in textile circularity.

Keywords: Automated textile sorting, post, consumer textiles, textile circularity, textile recycling, AI, based classification, multimodal perception (RGB/NIR), machine vision, robotic handling