Capafoldable: Self-tracking Foldable Smart Textiles With Capacitive Sensing

Lala Shakti Swarup Ray
DFKI
Kaiserslautern, Germany

Daniel Geißler
DFKI
Kaiserslautern, Germany

Bo Zhou
DFKI
Kaiserslautern, Germany

Paul Lukowicz
DFKI
Kaiserslautern, Germany

Berit Greinke
Universität der Künste Berlin
Berlin, Germany

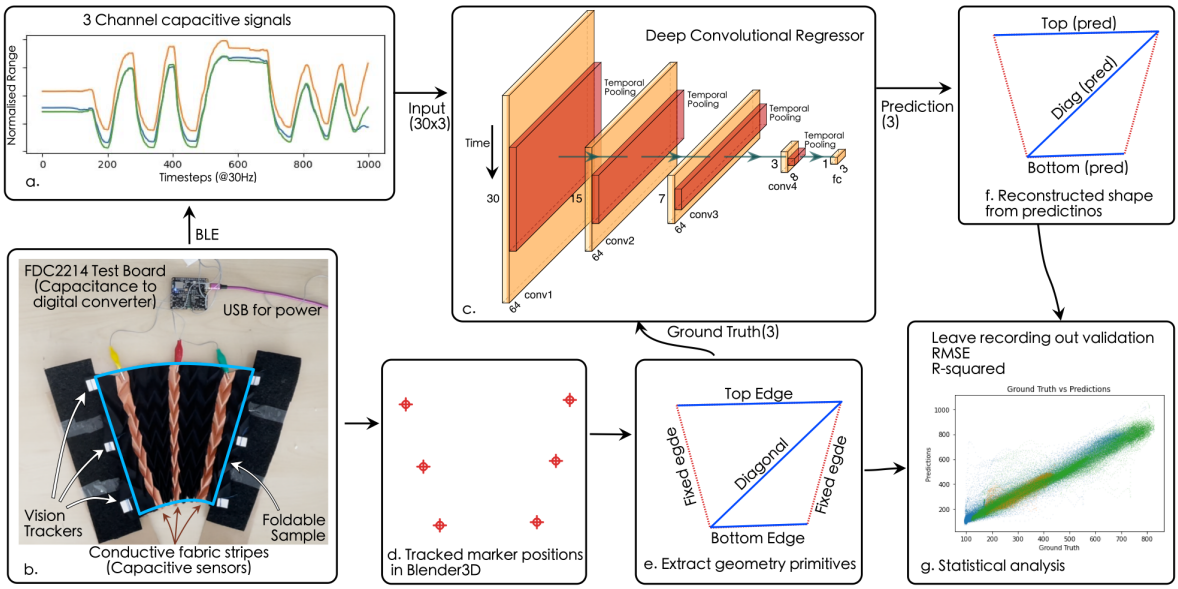

Figure 1: The tracking and machine learning pipeline for self-shape-tracking with capacitive sensing.

ABSTRACT

Folding is a unique structural technique to equip planar materials with motion or 3D mechanical properties. Textile-based capacitive sensing has shown to be sensitive to the geometry deformation and relative motion of conductive textiles. In this work, we propose a novel self-tracking foldable smart textile by combining folded fabric structures and capacitive sensing to detect the structural motions using state-of-the-art sensing circuits and deep learning technologies. We created two folding patterns, Accordion and Chevron, each with two layouts of capacitive sensors in the form of thermobonded conductive textile patches. In an experiment of manually moving patches of the folding patterns, we developed deep neural network to learn and reconstruct the vision-tracked shape of the patches. Through our approach, the geometry primitives defining the patch shape can be reconstructed from the capacitive signals with R-squared value of up to 95% and tracking error of 1cm for 22.5cm long patches. With mechanical, electrical and sensing properties, Capafoldable could enable a new range of smart textile applications.

CCS CONCEPTS

• **Human-centered computing** → **Ubiquitous and mobile computing**.

KEYWORDS

smart textile, folding textile, capacitive sensing, machine learning

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