Abstract

Despite recent advancements in wearable technologies and electronic textiles, barriers remain to achieving distributed computation located persistently on the human body. Here, a textile fibre that monolithically combines analog sensing, digital memory, processing, and communication, all within a mass of less than 5 grams is presented. Enabled by a foldable interposer, the 2D pad architectures of microdevices are mapped to 3D cylindrical layouts conforming to fibre geometry. An assembly of eight mm-size microdevices connected with helical copper microwires is thermally drawn into a machine-washable elastic fibre capable of over 60% stretch without failure. This programmable fibre, which incorporates a 32-bit floating point microcontroller, independently performs sensing, data storage, computation, and inference tasks even when braided, woven, knitted, or seam-sewn into garments, remaining nearly imperceptible to the wearer during extended use. The open architecture of the fibre computer and the universality of the assembly process allows for many additional functions to be added with simple modifications, including a rechargeable fibre power source that operates the computer for nearly six hours. Finally, we surmount the perennial limitation of rigid interconnects by implementing two wireless communication schemes involving woven optical links and seam-inserted RF communications. To demonstrate the utility of a multi-location fibre network, we incorporate four fibre computers into garments—one on each limb—each operating an independently trained neural network yielding an individual accuracy of around 80% in classifying physical activity. By implementing RF fabric networking and a weighted voting system, we boost the classification accuracy to nearly 100%, underscoring the potential for in-fabric networking and distributed inference.