Autonomy is the Key: From Smart towards Intelligent Textiles

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Introduction

Why would we want electronic textiles?

Why would we want electronic textiles to think for themselves?

Can we trust these electronic textiles to use our data safely?

With machine learning algorithms, electronic textiles can engage users to interact with it whilst simultaneously learning and building an understanding about its environment. Machine learning that operates autonomously creates intelligent electronic textiles, instead of smart textiles which do not learn over time and are dependent by an external operator.

For smart textiles to transition to intelligent textiles its learning must be autonomous to allow complete independent decision-making. Yet, although intelligent textiles have not materialised yet the technology is and therefore it is worth considering the security and ethical implications.

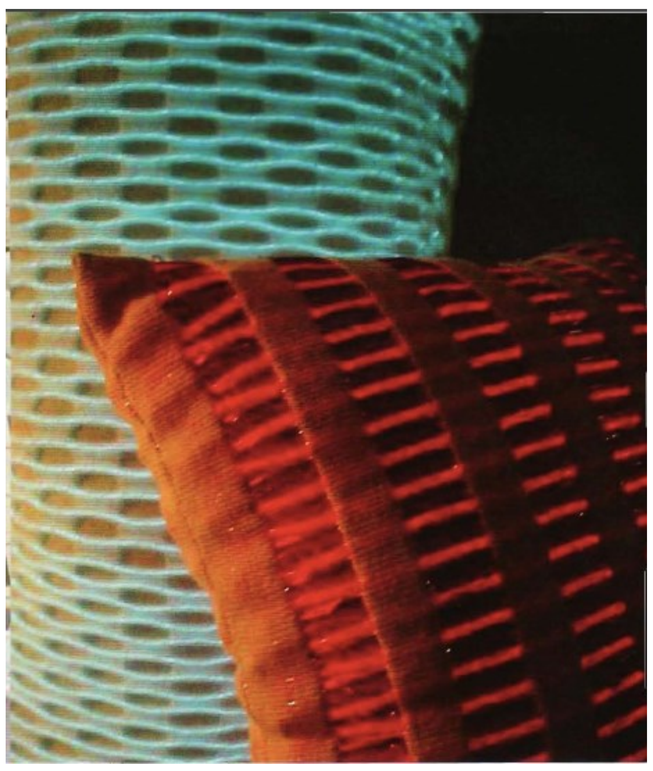

Fig. 1. Wirelessly connected pillows that change their aesthetic appearance when interacted with [4].

Machine Learning for Intelligent Textile Interactions

Machine learning algorithms that can build intuitive relationships between data, based on the categorization of this extracted data, can change user's perspective on interaction intelligence. Arguably, artificial intelligence algorithms used by intelligent textiles can provide understanding about the data it receives.

Machine learning algorithms has been used to increase a smart electronic textile's recognition of new behaviour [1]. Zhang and Harrison used Electrical Impedance Tomography (EIT) to measure the electrical impedance of the inner forearm to decipher hand gestures and finger-thumb pinches in real-time for non-verbal communication to control a smart watch [1].

Fig 2. Google's 'Project Jacquard' aims to commercialise interactive smart textiles that can connect to the Cloud, however intelligence is required to adapt to changes in use, context, and user [2].

Autonomous actions based on a deep understanding of the data it handles can improve its user's actions, environment, and relationships with other 'connected' objects if connected to The Cloud.

Smart textiles are gaining preference over wearable hardware devices for their compactness, softness, and flexibility [3]. A smart textile made from piezo-resistive material was worn on a finger to detect changes in pressure and strain [3]. Via a smartphone app, the system could recognise flexes of the piezoresistive finger sleeve with high precision to provide an eye-free interaction and control of connected devices.

This technology could widen the user-demographic of the assisted living industry, and potentially enable those with physical and mental impairments to control their environment with greater ease.

Personal Interactivity with Intelligent Textiles

Intelligent electronic textiles display decision-making attributes, based on input data extracted from user interaction. [4]. Interacting with intelligent textiles can provide helpful behavioural feedback and information about its environment – which can promote engagement, quantity of collected data, and the increase of contextual understanding.

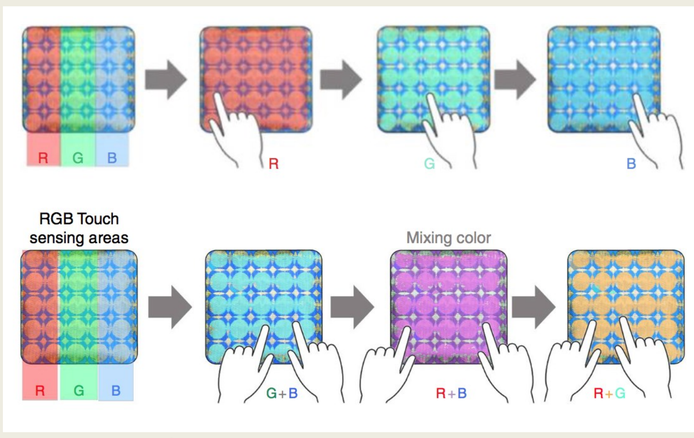

Fig 3. Decision-making behaviour of an electronic intelligent textile demonstrated by a change in visual appearance [4].

Intelligent electronic textiles which extract data and learn from increased interactivity over time can offer more personalised responses to user-behaviour.

If these intelligent electronic textiles could communicate and be recognised via their identity t6hrough radio frequency identification (RFID) tagging to aid assisted living in different locations [5], could help formulate a wellness sensor network [6].

This would create a wireless collective of shared knowledge within the network, improving conclusions, knowledge, and judgements to increase levels of intelligence and autonomy.

Final Considerations

Deploying digital governance [7] on the intelligent behaviours produced by intelligent electronic textiles, is a necessary act to provide security over the data that will be handled by it. This becomes more important as data manipulation becomes 'invisible' [2] - quicker and autonomous—hence, a data security framework is needed by the engineering industry that considered the ethical implications of what data intelligent electronic textiles can reveal and to whom .

In conclusion, intelligent electronic textiles will enable soft, flexible, and novel interfaces but to realise these commercially a reliable manufacturing methods [8] is needed. Nevertheless, the potential creation of intelligent electronic textiles when they are created is to change how we interact with textiles forever. It would be possible to turn any interaction with a textile into an intelligent communication of data.

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