School of Fashion and Textiles

Higher Degree Research Projects 2020

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School of Fashion and Textiles

Smart Textiles and Wearables for Protection, Comfort and Fashion

PhD/Masters by Research Project

Project Description

Smart Textiles and Wearables are multidisciplinary, involving textile engineering and technologies, material sciences, electrical/software engineering, computer science and design. They have the potential to revolutionise the textiles, clothing and fashion industry. The Smart Textiles and Wearables project focuses on the integration of intelligence and interactive interface features and functionalities in fibre materials and/or fashion features in garments to enhance material performance and wearer’s wellbeing and experience. This project is relevant to textiles with embedded electronics/sensors, or e-textiles, for intelligence functions, protection and aesthetics. It aims to investigate one or some aspects of the following:

- **Smart Protective Systems** – to create innovative solutions for applications in such fields as the military, public safety, sports, health and wellbeing, etc. The main objective is to add smart features without compromising protection performance and fit-for-purpose. (Example: automatically regulating the moisture and temperature of a body encapsulated by a clothing system without significantly increasing the load carriage burden and overall bulkiness of the system).

- **Wearable Electronics** – to interconnect technologies with textiles and allow electronics to be networked/function together. The key interests are energy harvesting and storage wearables, flexible batteries, embedded sensors, actuators, health monitoring system, surveillance, authentication, and intelligence gathering and decision making.

- **Smart Fashion and Garment Technology** – to apply design thinking and process in smart wearables. Approaches may include the Internet of Things, wearables for wellbeing and healthcare, entertainment, user experience, and fashion technology.

The applicant should be a graduate in an engineering, materials, science or design discipline, ideally with research experience/background in fibre science, electrical engineering, computing and modelling.

Relevant Literature


Supervisory Team

1st Supervisor: Prof Lijing Wang lijing.wang@rmit.edu.au
2nd Supervisor: Prof Ivan Cole
3rd Supervisor: Prof Min Gu
4th Supervisor: Prof Rajiv Padhye
**ECP Alignment:** Advanced Materials

**FoR Code(s):** 091012 Textile Technology  
120304 Digital and Interaction Design  
120306 Textile and Fashion Design
Fibre Material Hyperspectral Signal Analysis and Signature Management

PhD/Masters by Research Project

Project Description

Hyperspectral imaging collects information from across the electromagnetic spectrum beyond the visible light. Certain objects leave unique 'fingerprints' in the electromagnetic spectrum, which can be used to identify the objects that present in an environment. To increase survivability of service personnel, one of the measures to camouflage objects is to cover them with textiles that have the spectral signatures of a wide variety of terrains and natural environments. However, there is no systematic information about the fibre material spectral signatures for the covering/uniform design and signature management. This project, undertaken in collaboration with the Defence Science and Technology (DST) Group, aims to obtain the hyperspectral signal and analyse each pixel in the image of a scene, with the purpose of identifying materials, finding objects, or developing strategies of camouflage. It will establish a hyperspectral fingerprint library of typical coloured and coated fabrics. Digital signal processing techniques will be developed to synthesize images and identify special features within a virtual environmental image. A textile material solution for specific spectral bandwidth matching against field elements will be demonstrated. The developed technology will be used for designing camouflage military uniforms/coverings and testing how effective patterns are across the visual, ultraviolet, infrared and radar bands of the electromagnetic spectrum, to increase survivability of service personnel. The project outcome will enable the DST Group to understand potential material solutions for counter-measures against the hyperspectral imaging sensor threat.

(HDR applicants who are Australian citizens or permanent residents are preferred.)

For further information about this project see:  https://www.rmit.edu.au/students/student-essentials/information-for/research-candidates/enriching-your-candidature/grants-and-scholarships/2019/postgraduate-by-research/phd-scholarship-in-fibre-material-hyperspectral-signal-analysis-

Relevant Literature


Supervisory Team

1st Supervisor: Prof Lijing Wang lijing.wang@rmit.edu.au
2nd Supervisor: Dr Bin Lee
3rd Supervisor: Prof Rajiv Padhye
**ECP Alignment:** Advanced Materials, Information and Systems (Engineering)

**FoR Code(s):** 091012 Textile Technology  
080109 Pattern Recognition and Data Mining
School of Fashion and Textiles

Artificial Intelligence in Textile Identification

PhD/Masters by Research Project

Project Description
The brand and materials used for textiles govern the price differences of similar textile products. However, the identification of products with similar material qualities continues to be a huge challenge in the textile industry, resulting in the proliferation of textile counterfeiting, which damages brand names and consumer confidence. Australians are the world's second largest consumers of textiles, buying on average 27 kilograms of new clothing and other textiles per person each year. If the textiles are incorrectly or misleadingly labelled, the financial losses can be significant. This project aims to employ artificial intelligence tools and developing technologies to provide reliable forensic evidence and to scientifically identify the origin of textiles. There are many approaches to tackle the problem, for example:

**Automatic Identification of Australian Wool.** The accurate determination of Australian wool composition from different animal origins is an essential measure for combating fraud and maintaining the quality image of Australian wool products. This project aims to develop an artificial neural network classifier based on the physical properties of animal fibres to identify the fibre composition and type of animal fibre in a product.

**Origin of Animal Furs and Skins.** There are many luxury goods and fashion accessories made from exotic animal furs and skins. However, it is difficult to substantiate their origin without a scientifically analytical approach. This project aims to explore potential methods of determining the source of animal furs and skins. The outcome will also help forensic investigation.

**DNA Analysis of Textile Fibres.** This project will focus on plant- and animal-based fibre identification using polymerase chain reaction (PCR) and DNA sequencing methods. The outcome of this project will be to generate preliminary data supporting a model method and workflow for the identification of unknown fibres, in particular, in a finished textile product.

**Integrated RFID Tag in Textiles.** This project will seamlessly integrate fibre-based RFID technology for individual textile identification and to gather product life cycle information for supply chain activity tracking and sustainability study.

Relevant Literature

Supervisory Team
1st Supervisor: Prof Lijing Wang lijing.wang@rmit.edu.au
2nd Supervisor: Dr Weimin Gao
3rd Supervisor: Dr Faith Kwa
**ECP Alignment:** Advanced Materials, Information and Systems (Engineering)

**FoR Code(s):** 091012 Textile Technology
080109 Pattern Recognition and Data Mining
Project Description

Functionalising of textiles by nanoparticles has been the most promising way of developing performance textiles. The durability and comfort of the functionalized textiles are the issues that confine the application potential of the technology. This project aims to grow nanoparticles on textiles by selecting promising templates and developing novel synthesis methods, so that the size and shape of nanoparticles can be tuneable and the durability greatly enhanced by the templating effect. Growing of nanoparticles will also be incorporated into the manufacturing process of fabrics to maintain their comfort.

Nano-functionalization of textiles by traditional finishing methods, such as coating and surface modification, is the most straightforward and feasible method for developing protective textiles. This project aims to develop new coatings on textiles and to implement surface modifications on textiles to achieve versatile protection against water, liquids, oils, chemicals and others. Nanocomposites layers will be formed on textiles to realise these protections and the surface science will be investigated to contribute to the theory and application of the technology. Comfort will also be studied to further benefit the application of the developed protective textiles. The application of the developed technology from this project will be smart textiles and wearable technology such as textiles offering protection against different threats, the detection of pesticides, sensing, and wearable heating and e-textiles.

Relevant Literature


Supervisory Team

1st Supervisor: Dr Xin Wang xin.wang@rmit.edu.au
2nd Supervisor: Dr Shadi Houshyar
3rd Supervisor: Prof Rajiv Padhye

ECP Alignment: Advanced Materials

FoR Code(s): 091012 Textile Technology
091205 Functional Materials
100706 Nanofabrication, Growth and Self Assembly
School of Fashion and Textiles

Novel Electrospinning for Large Scale Fabrication of Nanofibres

PhD/Masters by Research Project

Project Description

Nanofibre has seen a great application potential in different areas. However, scaling up the production of nanofibres to fulfil the application needs is still a great challenge. This project will investigate the theory and fabrication method of electrospinning. Specifically, the mechanism of fabricating nanofibres from a concentrated electric field on different spinnerets will be revealed by understanding the electro-mechanical dynamics of electrospinning, and promising needleless electrospinning/novel electrospinning will be developed to enhance the production rate of nanofibres. Modelling of electrospinning will also be conducted to benefit the development of the new fabrication methods.

Relevant Literature


Supervisory Team

1st Supervisor: Dr Xin Wang xin.wang@rmit.edu.au
2nd Supervisor: Prof Rajiv Padhye
3rd Supervisor: Prof Lijing Wang

ECP Alignment: Advanced Materials

FoR Code(s): 091012 Textile Technology
091209 Polymers and Plastics
100707 Nanomanufacturing
Project Description

Current available treatment for large area peripheral nerve injuries involves grafting of the autologous nerve, which has several limitations including secondary site morbidity, misalignment and mismatch of regenerating axons, and structural incompatibility. Considering this, nerve guidance conduits have been researched using suitable polymers to improve the prognosis for repair. From our previous studies, we have observed that carbon nanofiber (CNF) dispersed poly-ε-caprolactone (PCL) nanocomposites exhibit the ability to support neural (PC12) cell attachment, division and differentiation without the use of cell adhesion molecules or surface modification. Hence, in this proposal, we intend to develop nerve conduits using new conductive materials based on knitted and nanocomposite structures. Conduits will be functionalized with suitable biomolecules for enhanced cell growth and will be tested in vitro.

The applicant should be a graduate in engineering, materials or science, ideally with research experience/background in fibre, polymer and material science. The candidate will have access to facilities at St Vincent's Hospital and the CSIRO, Clayton.

Relevant Literature


Supervisory Team
1st Supervisor: Prof Rajiv Padhye rajiv.padhye@rmit.edu.au
2nd Supervisor: Dr Shadi Houshyar
3rd Supervisor: Dr Ilias Louis Kyratzis (CSIRO)

ECP Alignment: Advanced Materials

FoR Code(s): 100708 Nanomaterials
Methods for Measuring Electrical Conductance of Textiles

PhD/Masters by Research Project

Project Description

The market for e-textiles and smart wearables for sensing, monitoring and data collection is predicted to be $475 billion USD by 2025. The combining of electronic components into textiles and textile products presents a unique set of hurdles (e.g. integrating hard and soft components, stretch, durability to laundering) which researchers and innovators need to overcome. Though there are many different and well-established methods of introducing effective conductivity into textiles (screen printing, coating, weaving or knitting conductive yarns, embroidery, etc.[1][3]), no new methods to measure the resulting electrical conductance have been developed in response to this burgeoning field. Current commonly used methods to measure the electrical conductance of textiles include two- and four-point probe methods, and Van der Pauw [2]. However, these methods are designed to measure conductivity of homogeneous, uniform materials. Textile materials are neither. Therefore, the appropriateness of these methods to measure the electrical conductivity of textiles, which are known to have high variability among replicates, is questioned. As the market and demand for e-textiles and conductive textile components grows, the need for an accurate, simple and reliable method to measure the conductance of fibres, yarns and fabrics cannot be underpinned. The aim of this PhD project is to evaluate currently used methods for measuring the effective conductivity of textiles, to better understand the relative sources of variability within these methods, and to develop a simple, accurate and readily available method to measure conductance of e-textiles and smart fabrics.

Relevant Literature


Supervisory Team

1st Supervisor: Dr Rebecca Van Amber rebecca.vanamber@rmit.edu.au
2nd Supervisor: Assoc Prof Anthony Holland (School of Engineering)

ECP Alignment: Advanced Materials

FoR Code(s): 091012 Textile Technology
School of Fashion and Textiles

Performance and Properties of Sustainable Materials

PhD/Masters by Research Project

Project Description
The fashion industry is currently undergoing a “green” revolution, with greater numbers of consumers and producers concerned about the environmental impact of fashion and textiles products. One of the methods commonly used by manufacturers to reduce impact is to use sustainable textiles materials.

Initiatives such as the H & M Foundation Global Change award are encouraging the development of new, alternative materials to traditional, more polluting materials as leather, polyester, nylon, etc. And global movements towards veganism are fueling the desire for alternatives to animal-based materials.

The aim of this research seeks to characterize and investigate the performance properties of a selection of so-called ‘sustainable’ textile materials, deeply examine and understand the life cycle analysis of not only production, but use of these materials, and finally critically examine whether the sustainable textile materials really are greener alternatives, or whether manufacturers are simply engaging in a new form of marketing: greenwashing.

Relevant Literature

Supervisory Team
1st Supervisor: Dr Rebecca Van Amber rebecca.vanamber@rmit.edu.au
2nd Supervisor: Dr Saniyat Islam
3rd Supervisor: Dr Jenny Underwood

ECP Alignment: Advanced Materials

FoR Code(s): 091012 Textile Technology
120306 Textiles and Fashion Design
India Ascending: Fashion Enterprise in India

PhD/Masters by Research Project

Project Description
With a rapidly growing economy, a booming middle class and a style-conscious and tech-savvy youthful population, India has been identified as a focal point for the international fashion industry; its apparel market is anticipated to be worth $59.3bn by 2022 (McKinsey 2019). Alongside these developments, legislation restricting the activities of foreign enterprises have been relaxed, and as a result India has become a key target for overseas brands and retailers, and domestic brands have evolved to become genuine competitors with foreign counterparts. However, India remains a challenging market, not least for its mosaic of cultural practices and traditions, its geographic scale and its reliance on informal retail environments and exchanges. Notwithstanding considerable research into Indian fashion consumer profiling and behavior, into entry methods for foreign participants in the market, and into the structure of the Indian fashion retail market, no research has yet provided a holistic view of the scale, scope and nature of the Indian fashion system. This project aims to study the diversity of fashion consumer and commercial practices; integrating Indian fashion consumer research with understandings of business models, strategies and practices in the Indian market in order to identify the success factors critical to the success of fashion enterprises in India.

Relevant Literature

Supervisory Team
1st Supervisor: Dr Stephen Wigley stephen.wigley@rmit.edu.au
2nd Supervisor: Dr Tarun Panwar

ECP Alignment: Global Business Innovation

FoR Code(s): 120306 Textiles and Fashion Design
150399 Business and Management not elsewhere classified
169903 Studies of Asian Society
School of Fashion and Textiles

Reconceptualising Fashion Retail

PhD/Masters by Research Project

Project Description
Almost 90,000 individual stores are predicted to close by 2026 in the USA, continuing a pattern of closures repeated across Australia and European retail markets for the past decade. With the growth of online shopping and declining footfall in shopping destinations worldwide, traditional retail outlets have come to be regarded as liabilities rather than assets, with property lease, mortgage, maintenance and staffing costs cited as unsustainable by multiple fashion businesses. This has impacted on the scale, scope and purpose of the traditional fashion store, across department store, multi-brand, independent, branded and boutique businesses. Notwithstanding this, the retail environment remains a prime venue for customer engagement, brand interaction and product trialing in fashion. Retail environments are also the target of innovation and technology investment as fashion enterprises seek to enrich and augment customer experiences and align brand identities and values across online and offline platforms. Meanwhile innovative forms of retail have reimagined the location, strategic purpose and in-market operation of the traditional store; pop-ups, showrooms, mobile, guerilla and co-branded stores have become mainstream for fashion enterprises. This project aims to critically understand the shifting strategic purpose of retail outlets within the broader marketing and sales strategy of a fashion enterprise. It will incorporate a conceptualization of digital technology (including AR, VR and AI) within the contemporary fashion retail environment and identify architypes and strategies employed by fashion enterprises across the commercial spectrum in planning, operating, and closing innovative retail platforms.

Relevant Literature

Supervisory Team
1st Supervisor: Dr Stephen Wigley stephen.wigley@rmit.edu.au
2nd Supervisor: Dr Tarun Panwar

ECP Alignment: Global Business Innovation

FoR Code(s): 120306 Textiles and Fashion Design
150501 Consumer-Oriented Product or Service Development
150307 Innovation and Technology Management
Project Description
A business model may be described from various perspectives. The perspective of organizational logic defines it as the capability for creating, capturing and delivering value; its building blocks are customers, value propositions, financial feasibility and the infrastructure to execute a business game plan (Osterwalder & Pigneur 2010). An activities-driven business model, argued by Afuah (2004), is the activity set relating to performance variables such as the nature of activities, and when and how their value may be increased. Zott & Amit (2010) explain a business model as a system that transcends a given company and enables that company, in the context of its partners, to create value. Weill and Vitale (2001) take a supply chain perspective and define a business model in terms of the role and relationships between supply chain partners, which identify flows of production and information. Recently we have seen the emergence of hybrid models such as the B Corp model. B Corp is a sustainable business model, according to which companies function with a traditional for–profit focus but with strong social commitments (Hiller 2013). Giesen et al. (2010) point out that business model innovation can be successful if companies are in sync externally, are carefully controlled, and remain flexible.

This project aims to critically evaluate emerging fashion business models from financial, environmental and social perspectives. Current business models are being shaken up, for example, by the challenge thrown to traditional retail stores by digital fashion businesses. The project aims to provide direction towards possible business models of the future.

Relevant Literature

Supervisory Team
1st Supervisor: Dr Tarun Panwar tarun.panwar@rmit.edu.au
2nd Supervisor: Dr Stephen Wigley

ECP Alignment: Global Business Innovation

FoR Code(s): 150312 Organisational Planning and Management
150309 Logistics and Supply Chain Management
120306 Textiles and Fashion Design
Project Description

Compulsive fashion buying, resulting in excessive and frequent unplanned purchases, can have negative impacts on the financial and emotional wellbeing of consumers. Compulsive buying is ‘chronic, repetitive shopping that becomes a primary response to negative events or feelings’ (O’Guinn & Faber 1989). Alternatively, compulsive buying is a ‘frequent preoccupation with buying or impulses to buy that is experienced as irresistible, intrusive, and/or senseless’ (Muller et al. 2005). Compulsive buyers tend to purchase objects they do not need and sometimes cannot afford (Hoyer & MacInnis 2001). Compulsive shopping is different from impulse shopping; impulse shopping is the momentary purchasing of specific merchandise at a particular time; compulsive shopping is enduring behaviour that centres on the process and not on the purchases themselves (Solomon 2004). Compulsive shopping is unnecessary, typically excessive, and potentially destructive of the lives of individuals, who fantasize about personal success and social acceptance while engaging in this behaviour (Jacobs 1986).

Dittmar et al. (2007) identify three core features of compulsive buying: consumers experience an irresistible urge to buy; consumers’ control over buying behaviour is lost; and consumers continue to buy despite adverse consequences on their personal, social, or occupational lives, and on their financial situation. Koran et al. (2006) add that, once an individual is unable to control their buying, they will frequently purchase unnecessary items or more than they can afford, and they will shop for longer periods than intended. From a scientific perspective, compulsive buying is frequently overlooked and has been classified as an impulsive control disorder not otherwise specified (Black et al. 1998; Mueller et al. 2007). Kasser and Kanner (2004) ascribe that the orientation of materialistic values is central to current consumer culture.

The research project proposes to develop a scale to measure compulsive buying tendencies and to investigate the relationship between compulsive buying and emotional, financial and mental wellbeing of the consumers of fashion.

Relevant Literature


Supervisory Team

1st Supervisor: Dr Tarun Panwar tarun.panwar@rmit.edu.au
2nd Supervisor: Dr Stephen Wigley

ECP Alignment: Design and Creative Practice

FoR Code(s): 120306 Textiles and Fashion Design
150506 Marketing Theory
170199 Psychology not elsewhere classified
School of Fashion and Textiles

Fashion Images: Fashion Bodies, Performance, Post-truths and Events

PhD/Masters by Research Project

Project Description

Fashion (bodies) are increasingly encountered, understood and experienced through image. The proliferated and mediated image streams of contemporary culture shift our embodied relationships as well as the forms of fashion. This practice-based project seeks an exploration of the exhaustive and embodied quality of fashion images, and how this transfigures notions of body, performance and the relationships with post truths, events and narrative in contemporary culture.

Fashion shows create and produce multiplicities of images. These are now rapidly disseminated and consumed digitally. We therefore increasingly contemplate and understand fashion through the spectacle of the image (Evans, 2008) and thus a disembodied experience of fashion emerges, posing questions around the performance and identity of the body within the image realm.

This project is primarily conducted through the practice of fashion as image making, and therefore key fields of research are Fashion Design, Performance, Visual Arts, Film and Photography. The project seeks to contribute to an emerging sphere of practitioners that are critically investigating fashion in expanded fields as ‘performed image’ and ideals around contemporary bodies, and include Joke Robaard, Femke de Vries and Bernadette Corporation. It is intended that related fields of fashion studies, photographic studies, art theory and criticism will form part of the research. The project intends to engage local and global fashion and arts communities through supervisor networks and create potential collaborative research outcomes.

Relevant Literature


Supervisory Team

1st Supervisor: Dr Ricarda Bigolin ricarda.bigolin@rmit.edu.au
2nd Supervisor: Assoc Prof Mikala Dwyer (School of Art)

ECP Alignment: Design and Creative Practice

FoR Code(s): 120306 Textiles and Fashion Design
190104 Visual Cultures