Pouyan GHABEZI

Technology Centre:	Irish Manufacturing Research, IMR
Academic Mentor:	Dr. Noel Harrison
Company Partner:	ÉireComposites Teo
Company Mentor:	Dr. Tomás Flanagan

Pouyan received his PhD degree in Mechanical Engineering, manufacturing and production, from the University of Tehran, Iran in 2017 focused on experimental-numerical modelling to determine nano-composite adhesive joints strength. In 2019, he started his postdoctoral research focused on degradation of composites – Decay project funded by National University of Ireland, Galway (NUIG) and the IComp centre, Ireland.

Dr. Noel Harrison

Dr. Noel Harrison is the Programme Director for the Bachelors and Masters Degrees in Mechanical Engineering in NUI Galway. His primary teaching areas are manufacturing and materials. He has a track record in advanced computational mechanics, experimental testing, material characterization, additive manufacturing (3D printing) of metal, composite and polymer feedstock, and 3D microscopy. He has also invented, patented and licensed novel medical device technology into industry. Dr Harrison is a Funded Investigator in the SFI research Centre (I-Form) for Advanced Manufacturing. He has established a research group on Advanced and Sustainable Manufacturing and Materials Engineering (www.asmme.ie) and developed the Advanced Manufacturing Lab. He is also Chair of the NSAI committee NSAI/TC 049/SC 02 Additive Manufacturing.

Dr. Tomás Flanagan

Dr Tomás Flanagan (M), CEO has a PhD from the University of Cambridge Engineering Design Centre, focused on design project planning and management with special emphasis on simulation and risk analysis. He previously worked in roles as Turnaround Project Manager at BP Norway and Offshore Construction team lead in BP Angola. He has also held roles in change management and in-house consulting within BP. Tomas joined ÉireComposites as a Marie Curie senior research fellow in 2014 and subsequently held the position of R&D director before becoming CEO. He has managed over €6m of research funding and was the principal investigator for the €2.7 H2020 Powderblade project on wind energy and the ongoing €3.9m H2020 CRIMSON project on tidal energy.

Irish Manufacturing Research (IMR)

Irish Manufacturing Research, IMR, is a leading Research and Technology Organisation providing a portfolio of research, training and consultancy services to Industry across four thematic pillars: Digitisation, Sustainable Manufacturing, Design for Manufacturing such as additive manufacturing, Automation and Advanced Control. IMR works with Irish Industry to assess ways to reduce energy consumption and how best to adopt a circular economy approach within their supply chain. IMR's vision is to enable manufacturing of all sectors and sizes to be leaders in the world of advanced manufacturing so that they can compete and thrive in the global economy.

ÉireComposites was established in 1998 and has over 60 employees. The company operates an accredited composites manufacturing and testing facility in Inverin, Galway. ÉireComposites is a design, manufacturing and testing company involved in lightweight high performance fibre-reinforced composites materials. The company was founded as a spin out from NUI Galway and maintains a strong research and development (R&D) focus. Their facilities are equipped with some of the most advanced equipment required for composite component manufacture.

Pouyan's project

"3DRecComp - Recycling environment and industrial waste composite and polymer materials into raw material extrusion feedstock, and the development of 3D printing of composites"

On the 16th January 2018, the European Commission published a European Strategy for Plastics in a Circular Economy requiring all Member States to reuse and recycle 50% of all plastic waste by 2025 and 55% by 2030. The excess production of composite materials in recent years, thereby huge volume of post-industrial trimmings and off-cuts from composite industries has started affecting highly our environment. Carbon and Kevlar fibres are high expensive materials; therefore, their waste in industry is a precious resource for recycling goals. 3D Printing (specifically Material Extrusion Additive Manufacturing) is a rapid and convenient manufacturing method. The technology has moved from laboratory rapid prototyping to consumer and domestic grade equipment over recent years. This process is suitable for use of recycled plastics and fibres from industrial waste, however to date, no clear recycling methods has been developed to convert waste composite and polymer parts into raw filament feedstock. To achieve this, this project relies on the expertise of a collaboration formed by ÉireComposites, the Technology Centre IMR, and NUI Galway.

The main steps of the proposed research program are as follow: collecting end-of–life composite parts, industrial wastes and environment waste (fibres and plastics); sorting of collected materials; use of recycling techniques to reuse composite waste (separation of fibres and plastics); modify and optimise recycling process for different materials; design and modify filament making methods; manufacturing filaments from recycled waste (fibrous filament and non-reinforced filament); quality control of filaments; design and optimization of a 3D printer in terms of hardware and software; 3D printing of new advanced components made of recycled filaments; mechanical testing and physicochemical characterization of 3D printed recycled composite parts to assess effect of fibre added and recycling process on the mechanical behaviour of new developed components; numerical simulation.onitoring threatened Irish habitats using UAVs and Deep learning techniques".

This project goal is to exploit the recent advances in Machine Learning (ML) and Unmanned Aerial Vehicles (UAVs) to map and monitor threatened habitats in Ireland. The proposed methods will allow for the automated creation of ecological maps. Namely, the research will be focused on the development of habitat mapping models based on deep learning, which is a subset of ML inspired in how information is processed in biological systems. The proposed project will unlock the possibility of automating the mapping of critical habitats in Ireland and enable future research for mapping other critical habitats.

The motivation for this project comes from the increasing need for high-quality habitat maps that allow monitory of the status of protected habitats. The European environment policy states as a priority objective the protection and conservation of ecosystems. Regular mapping of threatened habitats results in valuable information about the habitat status and is identified as a key step for the conservation of ecosystems. Hence, the European Union requires member states to periodically produce maps for the status assessments of threatened habitats in Europe. This increasing need for high-quality habitat maps has triggered research interest in efficient and methodologies to streamline and automate current habitat monitoring methodologies. This project aims to propose and analyse the power of novel ML-based models for mapping several protected habitats present in Ireland.