

<b><u>Information on Postgraduate Research Scholarship – Ref: FES-PhD-2324-02</u></b>	
<b>Faculty:</b>	FES
<b>Department:</b>	School of Engineering
<b>Lead Supervisor:</b>	Prof Gianluca Tozzi
<b>Project Title:</b>	Data-driven image mechanics (D <sup>2</sup> IM): a deep learning approach to predict displacement and strain fields in biological tissues from X-ray tomography
<b>Project Description:</b>	<p>The recent advent of deep learning (DL) has enabled data-driven models, paving the way for the full exploitation of rich image datasets from which physics can be learnt. Here at the University of Greenwich we recently developed a novel data-driven image mechanics (D<sup>2</sup>IM) approach that learns from digital volume correlation (DVC) displacement fields of bone, predicting displacement and strain fields for undeformed X-ray computed tomography (XCT) images [1]. This was the first study using experimental full-field measurements on bone structures from DVC to inform DL-based model such as D<sup>2</sup>IM, which represents a major contribution in the prediction of displacement and strain fields only based on the greyscale content of undeformed XCT images. The proposed PhD project will expand on this work to further develop D<sup>2</sup>IM capability by incorporating a range of biological structures (hard and soft tissues) and loading scenarios for accurate prediction of physical fields. The project will benefit from a unique InCiTe 3D X-ray microscope from our partner KA Imaging (<a href="https://www.kaimaging.com/industry-and-research-solutions/incite-micro-ct/">https://www.kaimaging.com/industry-and-research-solutions/incite-micro-ct/</a>) capable of sub-micron resolution and fast phase-contrast (first and only technology of this type in Europe), including in situ mechanics and dedicated software/coding solutions available at the Centre for Advanced Materials and Manufacturing (CAMM) as well as the Centre for Advanced Simulation and Modelling (CASM).</p> <p>The PhD candidate will be involved in the following work:</p> <ol style="list-style-type: none"> <li>1. Development of XCT protocols on the InCiTe 3D X-ray microscope including phase retrieval for in situ mechanics and DVC of hard and soft tissues.</li> <li>2. Development of novel DL strategies to enhance D<sup>2</sup>IM capability for a comprehensive prediction of displacement and strain fields in biological tissues, only based on the greyscale content of undeformed XCT images.</li> <li>3. Data analysis and dissemination. Data obtained from this project will be disseminated in high-impact journal papers and international conferences.</li> </ol>

	[1] Soar and Tozzi, 2023. Data-driven image mechanics (D <sup>2</sup> IM): a deep learning approach to predict displacement and strain fields from undeformed X-ray tomography images - Evaluation of bone mechanics. <a href="https://www.biorxiv.org/content/10.1101/2023.09.21.558878v1">https://www.biorxiv.org/content/10.1101/2023.09.21.558878v1</a>
<b>Duration:</b>	3 years, Full-Time Study or 6 years, Part-Time Study
<b>Bursary available (subject to satisfactory performance):</b> Year 1: £18,622 (FT) or pro-rata (PT) Year 2: In line with UKRI rate Year 3: In line with UKRI rate  In addition, the successful candidate will receive a contribution to tuition fees equivalent to the university's Home rate, currently £4,712 (FT) or pro-rata (PT), for the duration of their scholarship. International applicants will need to pay the remainder tuition fee for the duration of their scholarship.  This fee is subject to an annual increase.	
<b>Person Specification of Essential (E) or Desirable (D) requirements:</b>	
<b>Criteria:</b>	<b>E or D</b>
<b>Education and Training:</b>	
<ul style="list-style-type: none"> <li>1<sup>st</sup> Class or 2<sup>nd</sup> class, First Division (Upper Second Class) honours degree or a taught master's degree with a minimum average of 60% in all areas of assessment (UK or UK equivalent) in a relevant area to the proposed research project</li> </ul>	<b>E</b>
<ul style="list-style-type: none"> <li>For those whose first language is not English and/or if from a country where English is not the majority spoken language (as recognised by the UKBA), a language proficiency score of at least IELTS 6.5 (in all elements of the test) or an equivalent UK VISA and Immigration secure English Language Test is required, if your programme falls within the faculty of Engineering and Science a language proficiency score of at least IELTS 6.5 overall with a minimum of 6.0 in all elements of the test or an equivalent UK VISA and Immigration secure English Language Test is required. Unless the degree above was taught in English <u>and</u> obtained in a majority English speaking country, e.g. UK, USA, Australia, New Zealand, etc, as recognised by the UKBA.</li> </ul>	<b>E</b>
<b>Experience &amp; Skills:</b>	
<ul style="list-style-type: none"> <li>Previous experience of undertaking research (e.g. undergraduate or taught master's dissertation)</li> </ul>	<b>E</b>
<ul style="list-style-type: none"> <li>Experience in X-ray computed tomography and/or other imaging techniques</li> </ul>	<b>E</b>
<ul style="list-style-type: none"> <li>Experience in python and/or matlab coding</li> </ul>	<b>E</b>
<ul style="list-style-type: none"> <li>Experience in mechanics of biological tissues and biomaterials</li> </ul>	<b>D</b>
<b>Personal Attributes:</b>	
<ul style="list-style-type: none"> <li>Understands the fundamental differences between a taught degree and a research degree in terms of approach and personal discipline/motivation</li> </ul>	<b>E</b>
<ul style="list-style-type: none"> <li>Able to, under guidance, complete independent work successfully</li> </ul>	<b>E</b>
<b>Other Requirements:</b>	
<ul style="list-style-type: none"> <li>This scholarship may require Academic Technology Approval Scheme approval for the successful candidate if from outside of the EU/EEA</li> </ul>	<b>E</b>

<ul style="list-style-type: none"> <li>The scholarship must commence before <b>01/09/2024</b></li> </ul>	<b>E</b>
<b>Closing date for applications:</b>	<b>midnight UTC on 01/07/2024</b>
<b>For further information contact:</b>	<b>Prof Gianluca Tozzi (<a href="mailto:g.tozzi@greenwich.ac.uk">g.tozzi@greenwich.ac.uk</a>)</b>
<p><b>Making an application:</b> Please read this information before making an application. Information on the application process is available at: <a href="https://www.gre.ac.uk/research/study/apply/application-process">https://www.gre.ac.uk/research/study/apply/application-process</a>. Applications need to be made online via this link. <b>No other form of application will be considered.</b></p> <p>All applications <b>must include</b> the following information. <b>Applications not containing these documents will not be considered.</b></p> <ul style="list-style-type: none"> <li><b>Scholarship Reference Number (Ref)</b>– included in the personal statement section together with your personal statement as to why you are applying</li> <li><b>a CV including 2 referees *</b></li> <li><b>academic qualification certificates/transcripts and IELTS/English Language certificate if you are an international applicant or if English is not your first language or you are from a country where English is not the majority spoken language as defined by the UK Border Agency *</b></li> </ul> <p><i>*upload to the qualification section of the application form. Attachments must be a PDF format.</i></p> <p>Before submitting your application, you are encouraged to liaise with the Lead Supervisor on the details above.</p>	