

Biomedical Technologies and Innovation Doctoral Programme (BIOTIN)



Title of the PhD Project	Label-free single cell analysis in microfluidics devices using self-supervised deep learning
Acronym	DeepCell
Research Fields of the Project	Diagnostics Drug Testing
Keywords	Microfluidics, microfabrication, cell imaging, AI, deep learning
Host Institution, Department and Campus Location	Izmir Institute of Technology, Bioengineering Department, Urla/Izmir
PhD Awarding Institution and Graduate Programme	Izmir Institute of Technology, Graduate School, PhD in Bioengineering
Name and Affiliation of Main Supervisor	Assoc. Prof. Cumhuri Tekin (IZTECH)
Name and Affiliation of Co-supervisors	Assoc Prof. Mustafa Ozuysal (IZTECH) Assoc. Prof. Sinan Guven (IBG)
Research Environment and Infrastructure	Rapid prototyping tools, cleanroom facility, cell imaging facility, cell culture facility and well-equipped characterization and bioengineering centers (https://tam.iyte.edu.tr/en/homepage/)
Scientific Context of the Project	<p>Cancer cells have different physiological and biological characteristics. Utilizing these characteristic differences, different technologies could be created for cancer diagnosis and therapeutic purposes. In this proposed project, a new image-based cytometer method will be developed for automated, rapid, and reliable characterization of cells in a microfluidic chip by investigating the morphological, size, deformation, density, and magnetic properties of cells without using any labels. This method will be used for high-efficient detection of rare cancer cells among blood cells for diagnosis and prognosis purposes, as well as enabling the analysis of cancer cell responses to the drugs at the single-cell level.</p> <p>Related References:</p> <ol style="list-style-type: none"> 1. PNAS, 2015, 112, E3667-E3668. 2. ACS Sensors, 2021, 6, 2191-2201. 3. SPIE BIOS, LBIS, 2021, 1165509.

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Brief Workplan	1 st year: Literature review, trainings and simulations 2 nd year: Fabrication of chips and experimental setups 3 rd and 4 th year: Cell characterization experiments
Innovative Aspects of the Project	Novel cytometers will be developed by harmonizing microfluidics technology and deep learning-based data analysis that will enable sensitive and label-free single cell analysis.
Training Opportunities of the Project	Microfabrication, rapid prototyping, cell culture, cell analysis, microscopic imaging, image processing and AI tools
Interdisciplinary Aspects	Doctoral candidate will have the opportunity to work in an interdisciplinary team on microfluidic systems, cellular imaging systems, cell biology and analysis, image processing, and deep learning-based data analysis.
Intersectoral Mobility <input type="checkbox"/> Short Visit <input checked="" type="checkbox"/> Secondment	<i>Host: Siemens Healthineers (Türkiye or Germany)</i> <i>Context of Mobility: Research and Innovation Program</i>
Intersectoral Mobility <input checked="" type="checkbox"/> Short Visit <input type="checkbox"/> Secondment	<i>Host: Istanbul Health Industry Cluster (ISEK)</i> <i>Context of Mobility: Entrepreneurship Training, Thematic Pre-incubation Program</i>
International Academic Secondment	<i>Host Supervisor: Bojana Gligorjevic</i> <i>Host Institution: Temple University, Philadelphia, USA</i> <i>Host Department: Department of Bioengineering</i> <i>Duration: 6 months</i> <i>Estimated Time of Mobility: 2nd Year</i>
Main Supervisor	
Brief CV	Assoc. Prof. H. Cumhur Tekin E-mail: cumhurtekin@iyte.edu.tr ACADEMIC DEGREES Ph.D. Microsystems and Microelectronics Ecole Polytechnique Fédérale de Lausanne 2012 M.Sc. Electrical and Electronics Engineering Middle East Technical University, Turkey 2007 B.Sc. Electrical and Electronics Engineering Middle East Technical University, Turkey 2005 Google Scholar: https://scholar.google.com/citations?hl=en&user=mI9NbuQAAAAJ https://orcid.org/0000-0002-5758-5439

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Co-supervisors										
Brief CV	<p>Assoc. Prof. Mustafa Ozuysal</p> <p>E-mail: mustafaozuysal@iyte.edu.tr</p> <p>ACADEMIC DEGREES</p> <table><tr><td>Ph.D. Computer, Comm., and Info. Sciences</td><td>Ecole Polytechnique Fédérale de Lausanne</td><td>2010</td></tr><tr><td>M.Sc. Electrical and Electronics Engineering</td><td>Middle East Technical University, Turkey</td><td>2004</td></tr><tr><td>B.Sc. Electrical and Electronics Engineering</td><td>Middle East Technical University, Turkey</td><td>2002</td></tr></table> <p>Google Scholar: https://scholar.google.com.tr/citations?hl=tr&user=CfT5AZYAAAAJ https://orcid.org/0000-0003-0257-6882</p>	Ph.D. Computer, Comm., and Info. Sciences	Ecole Polytechnique Fédérale de Lausanne	2010	M.Sc. Electrical and Electronics Engineering	Middle East Technical University, Turkey	2004	B.Sc. Electrical and Electronics Engineering	Middle East Technical University, Turkey	2002
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M.Sc. Electrical and Electronics Engineering	Middle East Technical University, Turkey	2004								
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Brief CV	<p>Assoc. Prof. Sinan Guven</p> <p>E-mail: sinan.guven@ibg.edu.tr</p> <p>ACADEMIC DEGREES</p> <table><tr><td>Ph.D. Biomedicine</td><td>University of Basel, Switzerland</td><td>2011</td></tr><tr><td>M.Sc. Biotechnology</td><td>Middle East Technical University, Turkey</td><td>2006</td></tr><tr><td>B.Sc. Chemistry</td><td>Middle East Technical University, Turkey</td><td>2003</td></tr></table> <p>Google Scholar: https://scholar.google.com/citations?hl=en&user=AAW4wtsAAAAJ https://orcid.org/0000-0001-5212-5516</p>	Ph.D. Biomedicine	University of Basel, Switzerland	2011	M.Sc. Biotechnology	Middle East Technical University, Turkey	2006	B.Sc. Chemistry	Middle East Technical University, Turkey	2003
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