Dr Esin Ozturk Isik / Dr Maria Valdes-Hernandez

Newton Mobility Grants - 2015/R3
Application Ref: NI150340

Title:	Dr
First Name:	Esin
Surname:	Ozturk Isik
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Applicant Career Summary

Statement of qualifications and career:

Qualification	Date
Project grant £131800 from TUBITAK 1001 Research Projects Program for 'Determination of Multimodality Magnetic Resonance Imaging Based Biomarkers for Mild Cognitive Impairment in Parkinson Disease', (Award, PI)	October 2015 to October 2018
Project grant £35200 from TUBITAK 3501 National Young Researchers Career Development Program (CAREER) for 'Fast Phosphorus Magnetic Resonance Spectroscopic Imaging using Compressed Sensing for Imaging Brain Tumors' (Award, PI)	October 2012 to October 2014
Project grant £73990 from Marie Curie International Reintegration Grant (IRG) for 'Phosphorus MR Spectroscopic Imaging of Brain Tumors at 3T (31P_SPECTRA_3T)', (Award, PI)	April 2010 to April 2014
Assistant professor at Biomedical Engineering Institute, Bogaziçi University, Istanbul, TURKEY (Qualification).	September 2014-present
Assistant professor at the Department of Biomedical Engineering, Yeditepe University, Istanbul, TURKEY (Qualification).	December 2009-September 2014
Postdoctoral Fellow at Margaret Hart Surbeck Laboratory of Advanced Imaging, University of California at San Francisco, CA, USA (Qualification).	March 2007 to February 2009
Ph.D. in Bioengineering from the Joint Graduate Group in Bioengineering at University of California at Berkeley and University of Califonia at San Francisco, CA, USA (Qualification).	April 2007
M.S. in Biomedical Engineering from University of Alabama at Birmingham, AL, USA (Qualification).	December 2001
B.S. in Computer Engineering from Middle East Technical University, Ankara, TURKEY (Qualification).	June 1999

Field of Specialisation: Magnetic resonance spectroscopic imaging, cancer, parallel imaging, signal processing and analysis

Publications:	1. Comparison of the trifecta outcomes of robotic and open nephron-sparing surgeries performed in the robotic era of a single institution. Acar Ö, Isik EÖ, Mut T, Saglican Y, Onay A, Vural M, Musaoglu A, Esen T. Springerplus. 2015 Sep 4;4:472. doi: 10.1186/s40064-015-1274-2. eCollection 2015. 2. Classification of phosphorus magnetic resonance spectroscopic imaging of brain tumors using support vector machine and logistic regression at 3T. Er FC, Hatay GH, Okeer E, Yildirim M, Hakyemez B, Ozturk-Isik E. Conf Proc IEEE Eng Med Biol Soc. 2014;2014:2392-5. doi: 10.1109/EMBC.2014.6944103. 3. Final Gleason score prediction using discriminant analysis and support vector machine based on preoperative multiparametric MR imaging of prostate cancer at 3T. Citak-Er F, Vural M, Acar O, Esen T, Onay A, Ozturk-Isik E. Biomed Res Int. 2014;2014:690787. doi: 10.1155/2014/690787. Epub 2014 Dec 2. 4. Assesment of perfusion in glial tumors with arterial spin labeling; comparison with dynamic susceptibility contrast method. Cebeci H, Aydin O, Ozturk-Isik E, Gumus C, Inecikli F, Bekar A, Kocaeli H, Hakyemez B. Eur J Radiol. 2014 Oct;83(10):1914-9. doi: 10.1016/j.ejrad.2014.07.002. Epub 2014 Jul 15. 5. Accelerated phosphorus magnetic resonance spectroscopic imaging using compressed sensing. Askin NC, Atis B, Ozturk-Isik E. Conf Proc IEEE Eng Med Biol Soc. 2012;2012:1106-9. doi: 10.1109/EMBC.2012.6346128.
Subject:	Subject Group 04: Engineering, technology, instrumentation, materials science, experimental fluid dynamics / Computer engineering (including software)
Present Research:	The main aim of my current projects has been to develop novel molecular magnetic resonance (MR) imaging techniques to allow a better understanding of the underlying biochemistry on diseases. The technical projects at the Computational Imaging Laboratory of Bogazici University that I have established focus on designing new algorithms for molecular MR imaging data acquisition, post-processing and quantisation, as well as biostatistical analysis. This laboratory also works on developing computational methods for image analysis for understanding disease mechanisms. The main focus of my technical projects has been developing novel quantitative molecular MR imaging methodologies for fast and accurate data acquisition and processing. I have worked on translating all the projects developed at my laboratory to clinic in collaboration with clinical investigators at several hospitals for the benefit of the patients.
Present Position:	Assistant Professor
Present Employer:	Bogazici University
Present Department:	Institute of Biomedical Engineering
Present Position Start Date:	01/09/2014
Present Position End Date:	01/09/2024
PhD Awarded Date:	01/04/2007
PhD Expected Date:	

Co-Applicant Personal Details (Dr Maria Valdes-Hernandez)

Title:	Dr
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Preferred Name:	Maria
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Co-Applicant Career Summary (Dr Maria Valdes-Hernandez)

Statement of qualifications and career:

Qualification	Date
Post-Graduate Certificate in University Teaching (Qualification)	May 2012
PhD in Electronics and Informatics (Qualification)	Mar 2000
MSc in Electronics (Qualification)	Jul 1994
BEng in Electronics (Qualification)	Jul 1991
Fellowship of the Higher Education Academy (Award)	02 Aug 2012
Row Fogo Lecturer in Image Analysis (University of Edinburgh, UK) (Present post)	2011
Research Fellow in Brain Imaging (University of Edinburgh, UK) (Previous post)	2007
Software Engineer (Helixion Ltd, Edinburgh, UK) (Previous post)	2005
Post-Doctoral Fellowship in Image Processing (Gunma University, Japan) (Previous post)	2003
Specialist in Automatics (INEL Co., Cuba) (Previous post)	1996
PhD Scholarship from the Ministry of Education, Japan (Previous post and award)	1996
Associate Professor (Part-time, Central University of Las Villas, Cuba) (Previous post)	1993
Engineer in Electronics, Measurement Systems and Automatic Control (INEL Co. Cuba) (Previous post)	1991
Project grant £5700 from the Scottish Crucible and the Scottish Government (Award, PI)	Jan 2013 to Jan 2014
Collaborative project grant £36000 from the National Research Foundation, South Korea (Award, co-applicant)	Sept 2012 to Sept 2014
Project Grant £20700 from the Centre for Cognitive Ageing and Cognitive Epidemiology (Awad, Co-applicant)	Jan 2012 to Jun 2013
Project grant £1200 from Royal Society of Edinburgh (Award, co-applicant)	Oct 2011 to Oct 2012
International Exchange Grant £2,240 from Royal Society of Edinburgh (Award, PI)	Oct 2011 to Apr 2012
Summer project scholarship grant £1200 from Medical Research Scotland (Award, PI)	2013
Summer project scholarship grant £1080 from Wellcome Trust (Award, PI)	2012
Summer project scholarship grant £1080 from Wellcome Trust (Award, PI)	2010

Field of Specialisation: Medical Image Processing and Analysis and Signal Processing

Publications:	1) White matter hyperintensities and normal-appearing white matter integrity in the ageing brain Munoz-Maniega, S., Valdes Hernandez, M., Clayden, J. D., Royle, N., Murray, C., Morris, Z., Aribisala, B., Gow, A., Starr, J., Bastin, M., Deary, I. & Wardlaw, J. Feb 2015 In : Neurobiology of Aging. 36, 2, p. 909-918 2) Exploratory analysis of dietary intake and brain iron accumulation detected using magnetic resonance imaging in older individuals: the Lothian Birth Cohort 1936 Valdes Hernandez, M., Allan, J., Glatz, A., Kyle, J., Corley, J., Brett, C., Munoz-Maniega, S., Royle, N., Bastin, M., Starr, J., Deary, I. & Wardlaw, J. Jan 2015 In : The Journal of Nutrition, Health & Aging. 19, 1, p. 64-69 3) A comparison of location of acute symptomatic versus 'silent' small vessel lesions Valdes Hernandez, M., Maconick, L. C., Munoz-Maniega, S., Wang, X., Wiseman, S., Armitage, P., Doubal, F., Makin, S., Sudlow, C., Dennis, M., Deary, I., Bastin, M. & Wardlaw, J. 2015 In : International Journal of Stroke. 10, p. 1044–1050 4) Textural Characterization on Regions of Interest: A Useful Tool for the Study of Small Vessel Disease Viksne, L., Valdes Hernandez, M., Hoban, K., Heye, A. K., Gonzalez-Castro, V. & Wardlaw, J. 2015 Proceedings of the 19th Conference on Medical Image Understanding and Analysis. p. 66-71 6 p. 5) What are white matter hyperintensities made of? Relevance to vascular cognitive impairment Wardlaw, J., Valdes Hernandez, M. & Munoz-Maniega, S. 2015 In : Journal of the American Heart Association. 4, p. 001140
Subject:	Subject Group 04: Engineering, technology, instrumentation, materials science, experimental fluid dynamics / Computer engineering (including software)
Present Research:	To develop new and optimise existing image processing techniques for their application to the field of medical image analysis. This includes: 1) capturing and characterising features of morphological brain changes and monitoring lesion progression 2) assessing new imaging biomarkers clinically known to be associated with neurological diseases, neuroinflammation and dementia but not yet quantifiable 3) differentiating the new biomarkers by their severity, reflected by subtle and gradual intensity differences in focal and well delineated brain regions to measure depth and signal magnitude and not just volume of affected tissue 4) making these techniques available through competitive software applications to the international research community for their use in trials of treatments to prevent neurodegenerative diseases 5) improving image quality and resolution through the use of data fusion and multimodal multispectral magnetic resonance techniques
Present Position:	Row Fogo Lecturer in Medical Image Analysis
Present Employer:	Centre for Clinical Brain Sciences, University of Edinburgh
Present Department:	Department of Neuroimaging Sciences
Present Position Start Date:	01/03/2011
Present Position End Date:	01/03/2018
PhD Awarded Date:	31/03/2000

PhD Expected Date:

Organisation

University of Edinburgh

Proposal

Subject: Subject Group 04: Engineering, technology, instrumentation, materials science, experimental fluid dynamics / Computer engineering (including software)

Project Title: Feasibility study of obtaining high-resolution spectroscopy images using data fusion techniques

Research Aims: 1) To develop a pipeline to increase the resolution of magnetic resonance spectroscopy images to:
a) Provide the international scientific and research community a technique to study tissue microstructure and metabolic changes in neurological diseases
b) Increase research output by optimising tissue characterisation complementing the information from multimodal and multispectral magnetic resonance imaging with the application of this technique
2) To explore the feasibility of extrapolating the principle of the technique developed to results obtained from the emerging field of compressed sensing
3) To explore new avenues for collaboration between the laboratory led by the Applicant, and the Departments of Neuroimaging Sciences and the Compressed Sensing Group (University of Edinburgh)

Start Date: 15/03/2016

End Date: 15/03/2017

Research proposal:

Magnetic resonance spectroscopy (MRS) provides biochemical information of tissues non-invasively, whereas magnetic resonance imaging (MRI) only informs on the macro-/micro-structure of these tissues (i.e. the distribution of water and fat). The types of biochemicals (metabolites) that can be studied using MRS include choline-containing compounds (components of cell membranes), creatine (involved in energy metabolism), inositol and glucose (involved in energy release and consumption), N-acetyl aspar, alanine and lactate among others. However, despite its potential use in clinical diagnosis and disease treatment, at present MRS is almost exclusively used for medical research projects, being its low spatial resolution, despite its long acquisition time, the major cause of its lack of usage.
The Co-applicant has 5 years of experience on developing super-resolution techniques, these being applied to the field of remote sensing (see Valdes and Inamura (2000), IEEE Trans Geo Remote Sensing 38(5):2426-2430, and Valdes and Inamura (2001), Int J Remote Sensing 22(4):629-642), and 7 years of experience on research on brain mineral deposition: its assessment from conventional MRI, characterisation, causes, clinical correlates and effect on human health (see http://www.research.ed.ac.uk/portal/en/persons/maria-valdes-hernandez(f22f22d9-52bb-4883-bf94-52aa23a691e1).html). The Applicant has more than 18 years of experience in MRS (see http://www.esinozturkisik.com).
This project explores the feasibility of using the approach developed by the Co-applicant (described in Valdes and Inamura (2000)) to increase the spatial resolution of MRS using high-resolution structural MRI. A fully interconnected neural network is trained with structural MRI downsampled to the same resolution of the MRS data (input layer) and MRS in its actual resolution (output layer). Once the error in the iterative “learning” process reaches the global minimum, the original high-resolution MRI is input to the trained network hoping to obtain high-resolution MRS data. The Applicant will conduct the validation of the results.
Existent structural (voxel size 1x1x2mm3) and diffusion (voxel size 2x2x2mm3) MRI, and MRS (voxel size 10x10x10mm3) data from a sample of The Lothian Birth Cohort 1936 Study (https://en.wikipedia.org/wiki/Lothian_birth-cohort_studies) will be used.
Researchers from the Department of Neuroimaging Sciences at the University of Edinburgh, as part of Edinburgh Imaging (http://www.ed.ac.uk/schools-departments/clinical-sciences/edinburgh-imaging/home/), collaborate with the Edinburgh Compressed Sensing Group (http://www.see.ed.ac.uk/drupal/compressed-sensing). The Applicant have been working on achieving a five-fold MRS scan time reduction using compressed sensing. We also aim to organise a half-day event (workshop followed by a brain-storming session) during the visit of The Applicant to Edinburgh to explore new avenues for collaboration on applying super-resolution techniques to post-process results obtained from compressed sensing techniques. Further, the Co-applicant or a participant from the Edinburgh team will travel to the Applicant institution to participate on a similar activity.
MRS is currently used to investigate a number of diseases, most notably cancer, epilepsy, Alzheimer's Disease, Parkinson's disease and Huntington's disease. We hope that our approach contributes to increase the use of MRS on other areas of clinical research and contributes to make it attractive to be also used in clinical practice.

Resources required:	1) Professor Joanna M. Wardlaw (http://www.ed.ac.uk/schools-departments/clinical-brain-sciences/people/principal-investigators/prof-joanna-wardlaw): Experienced neuroradiologist, Principal investigator on The Lothian Birth Cohort 1936 Study, which will provide data for this feasibility study, world leader in stroke and small vessel disease, head of the Department of Neuroimaging Sciences at the University of Edinburgh, funder of Edinburgh Imaging and numerous pooling initiatives, being the most relevant to this application SINAPSE collaboration (http://www.sinapse.ac.uk/). 2) Professor Ian J. Deary (http://www.ppls.ed.ac.uk/psychology/people/ian-deary): Director of the University of Edinburgh Centre for Cognitive Ageing and Cognitive Epidemiology, Principal investigator on The Lothian Birth Cohort Studies, which will provide data for this feasibility study, world leader in cognitive ageing and cognitive epidemiology. 3) Professor Ian Marshall (http://www.ed.ac.uk/schools-departments/clinical-brain-sciences/people/principal-investigators/professor-ian-marshall): Chair of Magnetic Resonance Physics at the University of Edinburgh, with vast experience in spectroscopy and compressed sensing, who led the acquisition of the MRS data that this feasibility study will use. 4) Professor Mike Davies (http://www.see.ed.ac.uk/drupal/udrc/people/edinburgh-consortium/professor-mike-davies): head of the Institute for Digital Communications and leader of the Edinburgh Compressed Sensing Research Group. His research group is currently exploring the use of compressed sensing in a range of applications including MRI.
Participants:	1) Dr. Victor Gonzalez Castro (http://www.research.ed.ac.uk/portal/en/persons/victor-gonzalezcastro(d0820c85-c75e-47dc-a034-cadf9979f6a0).html): Row Fogo Lecturer in Image Analysis at the same Department as the Co-Applicant, with experience in image processing and interest in contributing to the project.
Outline of Data Management and Data Sharing Plan:	The project will not generate data. The data to be manipulated is stored on a secure server at the University of Edinburgh and will not be shared and neither available elsewhere. This project involves the development of image/signal processing techniques for post-processing magnetic resonance acquired data. The study will be published on an open source journal, and the tools developed will be available to the international research community via an open source repository.
Comply with Policy on use of Animals:	Not applicable
Comply with Policy on use of Non-Human Primates:	Not applicable
Use of Animals in Research:	NO
Benefits to individuals/institutions:	This project will constitute a proof-of-concept to apply for larger collaborative grants between the institutions/research teams involved. This of course will have positive impact on the career progression of both the Applicant and the Co-applicant, and on the overall research carried out at the Departments involved from both institutions. This project's outcome will also impact positively on the progress and output of the ongoing studies that relate and/or provide data to the proposed project.

Benefits to UK: This collaboration will strengthen the good bilateral relations that UK and Turkey share, through the start of a collaborative work between the two institutions of the applicants involved.

Benefits to Overseas Country: This collaboration will strengthen the good bilateral relations that UK and Turkey share by supporting the development of a well-trained research community, and promoting economic development and social welfare through enhanced research and innovation capacity, through the start of a collaborative work between the two institutions of the applicants involved.

Lay Report: A magnetic resonance spectroscopy (MRS) scan provides biochemical information of tissues, whereas a magnetic resonance imaging (MRI) scan only informs on the structure and location of these tissues (i.e. the distribution of water and fat). The types of biochemicals that can be studied using MRS include components of cell membranes and substances involved in energy release, consumption and metabolism among others. Thus, for example, whereas MRI informs on the characteristics of a tumour, MRS can, in theory, inform how aggressive the tumour is. However, despite its advantages for disease diagnosis and treatment, at present MRS is almost only used on research, being its low resolution the major cause of it. On the other hand, MRI can have even 10 times higher the resolution of MRS. In other words, while a pixel from MRS is big and blurry, MRI can show, on the same region, a matrix of 10 by 10 pixels with more detailed information, just of different kind.
The Co-applicant during her PhD studies worked on optimising a type of artificial "neural network" (i.e. a kind of artificial intelligent algorithm) for increasing the resolution of images using other images of the same "scene" that were acquired with higher resolution. It works as follow: We have various sharp and detailed images on one side and a blurry image of the same place, just of another kind, at the other side. As the sharp images and the blurry one are from the same place, they are, necessarily, related, just we don't know how. Then, we average groups of pixels on the sharp images so as to obtain "equivalent" blurry images and then we try to discover the relationship between them and the originally blurry image that is at the other side. This is done by the neural network, which between both sides will have a layer of "hidden neurons" that will try to figure it out through a try and error "learning" process. Once this is achieved and we know how the initially blurry image relates to the other images (which we made also blurry), then we input to the network the originally and detailed sharp images hoping that the network will estimate a new image of the type of the blurry one but that will be sharp and detailed as the other ones. The Applicant will evaluate how well this estimation has been. A set of images for doing this evaluation already exists. Also, information from laboratory tests from the volunteers that provided these images is available, which could help in validating the results.
The Department where the Co-applicant works collaborates with other group of researchers on what is called "compressed sensing", which is a field in which the Applicant has been working as well, and precisely applied to MRS. Compress sensing is the technique that allow to reconstruct a signal during the times that it is not measured (i.e. an image in the pixels where there is no information). It is like doing an archaeological work where we have pieces of the object and need to reconstruct it using other pieces of information. We also aim to organise a half-day event (workshop followed by a discussion/brain-storming session) during the visit of the Applicant to Edinburgh to explore the possibility of collaborating on applying techniques like the one explained previously to results obtained from these mentioned compressed sensing techniques. Further, the Co-applicant or a participant from the Edinburgh team will travel to the Applicant institution to participate on a similar activity.

Is this a new collaboration?: YES

Financial Details

Financial Details:

Year	Payment type	Justification	Amount Requested
Year 1	Travel International	Dr. Ozturk Isik visit to Edinburgh, UK, one week, mid-July 2016: £1500 and Dr. Valdes-Hernandez visit to Istanbul, Turkey, one week, September 2016: £1500	**3,000.00**
Year 1	Subsistence	Dr. Ozturk Isik stay a week in Edinburgh, UK, mid-July 2016: £1870, and Dr. Valdes-Hernandez stay a week, on Istambul, Turkey, September 2016: £900	**2,770.00**
Year 1	Research Costs	Dr. Valdes-Hernandez: e-visa £20, workshop £50; Dr. Ozturk Isik: visa £130, workshop £30	**230.00**
Total			**6,000.00**

Sum requested from the Royal Society: 6000.00

Grant Tenure: 1 year

Justification of expenses: