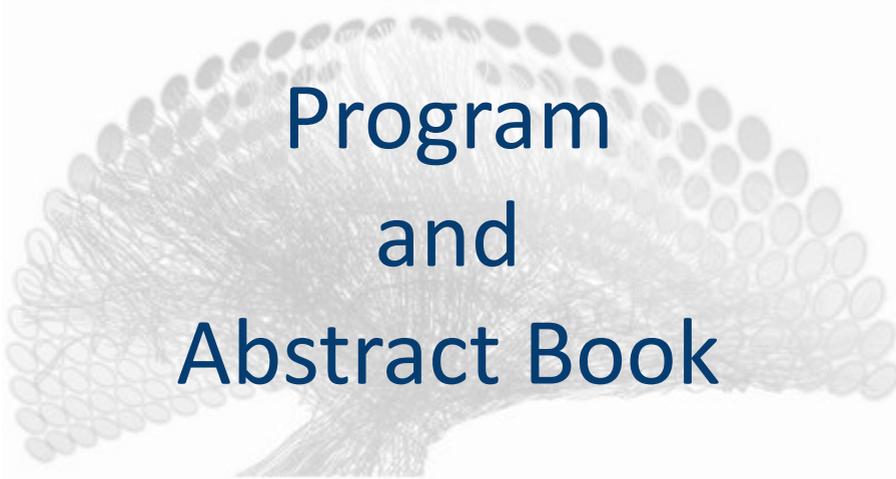


Emerging Concepts in
Advanced Imaging of
Neurodegenerative
Diseases

October 18-20, 2015

Boğaziçi University, TETAM Conference Hall, Kandilli, Istanbul



**Program
and
Abstract Book**



Organization for
Human Brain Mapping

TÜBİTAK

'Emerging Concepts in Advanced Imaging of Neurodegenerative Diseases' Workshop
Istanbul, 18-20 October 2015, Boğaziçi University

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Address

Boğaziçi University, TETAM Conference Hall

Kandilli, Istanbul

October 18, Sunday

09:00—10:00 Workshop Registration and Coffee

10:00—10:30 **Opening Remarks for the Workshop**
(Representatives of supporting universities and societies)

Overview of TÜBİTAK/NIH Bilateral Projects and Objectives of the Workshop
Esin Öztürk Işık - Cengizhan Öztürk - Tamer Demiralp

10:30—12:00 **Plenary Session 1**
Moderators: Emine Ülkü Sarıtaş, Hakan Gürvit

- Novel Imaging Protocols & Hardware - Ergin Atalar (Bilkent U, UMRAM)
- Imaging the Brain, Understanding the Mind: A Historical & Philosophical Perspective - Güven Güzeldere (Harvard U)

12:00—13:00 Lunch

13:00—14:30 **Panel Session 1** - Clinical and Research Priorities on Structural and Functional Connectivity in Neurodegenerative Diseases
Moderators: Chunlei Liu, Başar Bilgiç

- Intrinsic Connectivity Networks in Neurodegenerative Diseases - Hakan Gürvit (Istanbul U)
- Imaging in Neurodegenerative Diseases - Kader Karlı Oğuz (Hacettepe U, UMRAM)
- Computational Models of Neural Representation during Natural Behavior: A Potential Biomarker for Cognitive Deficits - Tolga Çukur (Bilkent U, UMRAM)
- Use of Connectivity Analysis in Disease Signature Extraction for Neurodegenerative Mental Disorders - Uğur Halıcı (METU)

14:30—15:00 Coffee Break

15:00—16:30 **Plenary Session 2** - MR Spectroscopic Techniques in Neurodegenerative Diseases
Moderators: Muhteşem Ağıldere, Esin Öztürk Işık

- Recent Developments in High Field MRS and Applications in Neurodegeneration and Psychiatric Diseases - Peter Barker (Johns Hopkins U)
- MRS Biomarkers of Neurodegeneration: Consideration for Multi-site Trials - Gülin Öz (U Minnesota)

16:30—17:00 Coffee Break

17:00—18:30 **Panel Session 2** - MR Spectroscopic Techniques in Brain Disorders
Moderators: Peter Barker, Gülin Öz

- Fast Multi Nuclei MR Spectroscopic Imaging of Brain Lesions - Esin Öztürk Işık (Boğaziçi U)
- The Reassessment of MRS as a Clinical Tool: The Impact of 32 Channel Head Coil and 3T - Alp Dinçer (Acıbadem U)
- ¹H-MR Spectroscopy of Focal Brain Lesions - Muhteşem Ağıldere (Başkent U)

18:30—21:00 Welcome Dinner

October 19, Monday

- 09:00—10:30
- Plenary Session 3** - Novel MR Techniques for Imaging of Neurodegenerative Diseases
Moderators: Cengizhan Öztürk, Aslı Demirtaş-Tatlıdede
- Quantitative Susceptibility Mapping (QSM) in Neurodegeneration - Chunlei Liu (Duke U)
 - MRI Acquisition & Processing Techniques to Study Neurodegeneration - Tugan Müftüler (Medical College of Wisconsin)
 - Integrated PET-MR Scanners and Their Applications - Azim Çelik (GE Healthcare)

10:30—11:00 Coffee Break

- 11:00—12:30
- Plenary Session 4** - Novel Imaging Protocols & Hardware Development
Moderators: Yekta Ülgen, Tugan Müftüler
- High-Resolution Diffusion MRI / Magnetic Particle Imaging - Emine Ülkü Sarıtaş (Bilkent U, UMRAM)
 - Medical Device Advances in Interventional MRI - Özgür Kocatürk (Boğaziçi U)

12:30—13:30 Lunch

- 13:30—15:00
- Panel Session 3** - Diffusion MRI Techniques in Neurodegenerative Diseases
Moderators: Gözde Ünal, Burak Acar
- An Early Registration Method for Group Tractography - Aziz Uluğ (Feinstein Med. Cent.)
 - Characterizing Diffusion Anisotropy with a Stiffness Tensor - Evren Özarslan (Boğaziçi U)
 - Post-Analysis Techniques for Diffusion MRI in Neuroimaging - Gözde Ünal (ITU)

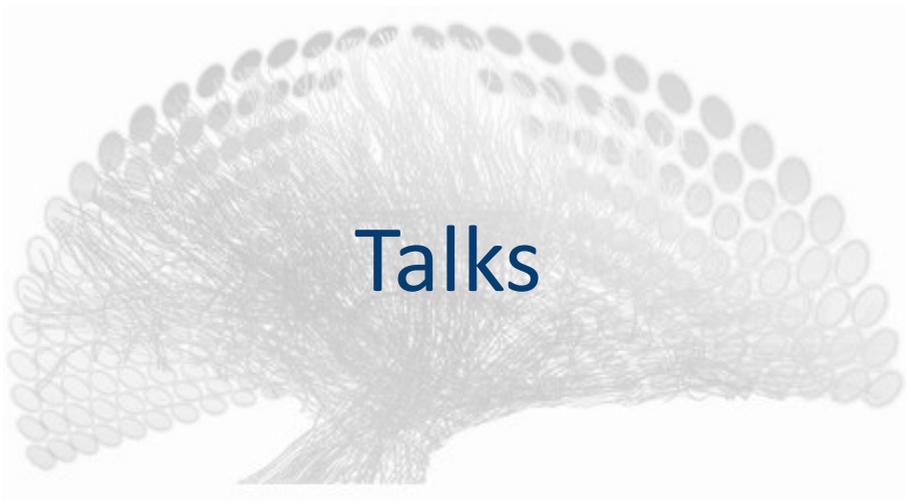
15:00—15:30 Coffee Break

- 15:30—17:00
- Panel Session 4** - Computational Approaches for the Imaging and Monitoring of Neurodegenerative Diseases
Moderators: Haluk Bingöl, Ali Albert-Salah
- Brain Network Analysis - Burak Acar (Boğaziçi U)
 - Continuous Monitoring PD patients in Daily Living Environments Using Wearable Sensors - Cem Ersoy (Boğaziçi U)
 - Fusion of Facial Expression Images with EMG Recordings to Determine the Level of Bradykinesia in Parkinson's Disease - Didem Gökçay (METU)

- 17:00—19:00
- Round Table Discussion 1**
Open Questions in Functional and Structural Connectivity and MRS Based Approaches to Neurodegenerative Diseases & Possibilities for Joint Projects
- Moderators: Güven Güzeldere, Tamer Demiralp
- (Short presentation of Turkish research groups)*

October 20, Tuesday

09:00—09:30	Plenary Session 5 Moderators: Cengizhan Öztürk <ul style="list-style-type: none">• Traumatic Brain Injury Induced Neuroendocrine Changes - Fahrettin Keleştemur (The Turkish Institutes of Health Sciences, President)
09:30—11:30	Round Table Discussion 2 Novel MR Techniques and Computational Methods for Analysis of Neuroimaging Data in Neurodegenerative Diseases & Possibilities for Joint Projects Moderators: Aziz Uluğ, Tolga Çukur <i>(Short presentation of Turkish research groups)</i>
11:30—12:00	Bilateral TÜBİTAK/NIH Funding Opportunities - Zeynep Arzıman Büyükboduk (TÜBİTAK, UIDB)
12:00—12:30	Summary of Roundtable Discussions and Closing Remarks (15 min summary of each Round Table Session) Esin Öztürk Işık - Cengizhan Öztürk - Tamer Demiralp
12:30—13:30 Lunch	



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Novel Imaging Protocols & Hardware

Ergin Atalar

UMRAM, Bilkent University, TR

Ergin Atalar received his B.S. degree from Bogazici University in 1985, M. S. degree from Middle East Technical University in 1987, and Ph.D. degree from Bilkent University in 1991, all in Electrical Engineering. Immediately after graduation he joined the Johns Hopkins University, where he became a Professor of Radiology, Biomedical Engineering and Electrical and Computer Engineering and Director of Center for Image Guided Interventions. Currently, Dr. Atalar is a Professor of the Department of Electrical and Electronics Engineering and the Director of National Magnetic Resonance Research Center at Bilkent University. He is also a founder of MRI Interventions, Inc and Troyka Med A. S. The main research interests of Dr. Atalar are novel magnetic resonance imaging technologies. He is an ISMRM fellow and won the TUBITAK science award in 2006. Dr. Atalar is author of 100 peer-reviewed journal papers and inventor of 42 US patents.

Since the invention of the magnetic resonance imaging, the advancement of both imaging protocols and hardware did not slow down. In this talk, I plan to explain some recent very exciting imaging protocols and hardware which did not find its way to routine clinical practice as of October 2015.

Among the new imaging protocols, the most popular one is the method called “simultaneous multi-slice” or SMS imaging. In this protocol, a multi-spectral RF pulse selects

3 or 4 slices simultaneously generating an image that is sum of these slices. Later using the sensitivity weighing from each of the coils, the images are separated out. With this technique the imaging time reduced without paying penalty for SNR. Of course this time gain can be used to improve image quality. One of the main challenge of this technique is the increased SAR due to multi-spectral RF pulses. Transmit array technology is under development to alleviate this problem.

Second subject of interest is the development of methods for ultra-short echo time or UTE images. This is achieved by improving hardware and software of the MRI scanners as well as developing new data collection techniques. Some researchers including our own group is working on zero-echo time imaging (ZTE). Using these techniques the new image contrasts become available for obtaining new diagnostic information.

Imaging patients with implants is another major advancement in the field of MRI. In addition to safety aspects that needs to be addressed, the image artifacts due to implants should be corrected.

The MRI technology continues to improve every day. This talk will be an incomplete overview of the recent developments

Imaging the Brain, Understanding the Mind: A Historical & Philosophical Perspective

Güven Güzeldere

Department of Psychology, Harvard
University, USA

Studies that relate structures of the brain to distinct mental functions, which peak during the Age of Enlightenment, have an extended history that go back to the Hellenistic Period. The effort to discovering correlations between functional brain components and processes, and corresponding states of the mind, on the other hand, is a much more recent phenomenon. While the most preliminary studies of how cerebral brain metabolism relates to cognition were conducted in the late 19th Century, the new revolution in the cognitive neurosciences owes its impetus to the very recently developed imaging technologies, approximately since the 1990s.

In light of the history of both structurally and functionally investigating the brain in order to better understand cognition, mind, and self, where can we locate and evaluate our present efforts in brain imaging; how should we model a physical system internally representing an external world; and what can we hope for near-future research? This talk will present a historical and theoretical framework in an attempt to answer these questions.

Intrinsic Connectivity Networks in Neurodegenerative Diseases

Hakan Gürvit

Istanbul Faculty of Medicine, Department of Neurology, Istanbul University, TR

He received his M.D. degree from Istanbul University, Istanbul Faculty of Medicine in 1983, completed his neurology residency training in 1991 at the Neurology Department of Istanbul Faculty of Medicine. This included a 6-month rotation at the Behavioral Neurology Unit of Harvard University at Beth Israel Hospital, Boston, USA with Dr. M.-Marsel Mesulam. He became an instructor in neurology at Neurology Department of Istanbul Faculty of Medicine in 1992. His research interests became focused in behavioral neurology. In 1995, he became a member of the newly founded Behavioral Neurology and Movement Disorders Unit at the department. Thenceforth his routine clinical practice has mainly been with Alzheimer's and Parkinson's patients. He became associate professor in 1997 and full professor in 2009. He was among the founders of Turkish Alzheimer's Association and Turkish Brain Research Association.

connectivity patterns. However, as human cognition is the unique feature of the species, analogy with the non-human primate brain could be far-fetched. In time, different neurodegenerative processes as progressive disorders of distinct cognitive profiles have become associated with distinct neural networks. Turn of this century witnessed a major breakthrough in human brain imaging, which allowed the imaging of functional neural networks in living human beings, the so-called intrinsic connectivity networks (ICNs). These networks were somewhat overlapping with the previously supposed anatomical connectivity patterns, but not completely identical with them. In due time, evidence started to accumulate suggesting the vulnerabilities of different ICNs to distinct type of neurodegenerative processes. As Pievani et al suggested (Lancet Neurol 2011) "Connectivity is a distinctive feature of the brain and the integrity of functional network dynamics is crucial for normal functioning. A better understanding of network disruption in the neurodegenerative dementias might help bridge the gap between molecular changes, pathological changes, and symptoms." Recent advances in the field will be reviewed in this talk.

During the second half of the 20th century neuroanatomical tracing methods allowed the elucidation and mapping of the anatomical connectivity pattern of non-human primates. Due to extensive genetic homology, parallels were drawn between the primate and human brain, and human cognition was started to be understood as subserved by large-scale neuroanatomical networks that was based on those

Imaging in Neurodegenerative Diseases

Kader Karlı Oğuz

Faculty of Medicine, Department of
Radiology, Hacettepe University, TR

Dr. Oguz received her MD degree in Hacettepe University, School of Medicine in 1995 and started radiology residency programme. Following completion of radiology residency in Hacettepe University, she did a research neuroradiology fellowship in Johns Hopkins University Department of Radiology in 2001. Back in Turkey, she has been working in Neuroradiology division of Hacettepe University since then. In 2011-2012 She worked as a visiting professor in Bilkent University, National Magnetic Resonance Research Centre to conduct studies on neuroimaging. She works at Hacettepe University as a senior clinical neuroradiologist and also conducts studies on advanced MR imaging and neurooncology in UMRAM. Her research interests include neurodegenerative diseases and inherited metabolic disorders, epilepsy, autoimmune and inflammatory diseases.

mainly to rule out space occupying mass such as glioma or subdural hematoma, which are not uncommon in advanced age. Then the tissue loss, namely atrophy of the brain is evaluated in terms of regions, cortical vs. subcortical, and symmetry is assessed because the atrophy usually follows the pattern in neurodegeneration providing the diagnosis. Metabolic imaging using PET enables a pre-clinical diagnosis and usually more extensive involvement than MRI. Microstructural and functional changes in the brain tissue could be searched by diffusion tensor imaging and functional MRI using BOLD, which provide distinct network alterations occurring in harmony with neurodegeneration. In this brief talk, major concepts in neuroimaging related with neurodegenerative diseases will be discussed.

Through a very complicated, still unraveling cascade of events of deregulated genes and proteins, propagation of misfolded proteins, inflammation and associated network-based loss of neurons and function, so called 'neurodegeneration' occurs. Imaging plays a role in understanding pathophysiology, recognition and follow-up of the disease, monitoring the effect of drugs in progress. Morphological assessment of the patients with dementia start with a conventional magnetic resonance imaging (MRI) study

Computational Models of Neural Representation during Natural Behavior: A Potential Biomarker for Cognitive Deficits

Tolga Çukur

UMRAM, Bilkent University, TR

Dr. Tolga Çukur graduated from Bilkent University in 2003 with a B.S. degree in Electrical and Electronics Engineering. Dr. Çukur pursued his graduate studies in the Department of Electrical Engineering at Stanford University, and received his M.S. and Ph.D. degrees in 2005 and 2009, respectively. He was a postdoctoral research fellow in the Helen Wills Neuroscience Institute at the University of California, Berkeley during 2010-2013. Since September 2013, he is a faculty member in the Department of Electrical and Electronics Engineering, the National Magnetic Resonance Research Center (UMRAM), and the Neuroscience Program at Bilkent University. Dr. Çukur's research interests include rapid data acquisition, image reconstruction, and statistical analysis strategies for MRI, with a broad range of applications including angiographic, cardiac, cellular, and functional imaging. His most recent work focuses on building quantitative models of the human visual system during natural stimulation, using functional MRI measurements.

Sensory and attentional deficits are hallmark symptoms of early-stage cognitive impairment in neurodegenerative diseases. However, routine behavioral tests of cognitive function fail to provide quantitative

assessments and to monitor diffuse disease progression across the brain. Therefore, there is a pressing need for computational imaging biomarkers that map daily-life sensory and attentional function across the brain. Unfortunately, traditional neuroimaging paradigms, optimized for hypothesis testing under simplified laboratory settings, have proven to be of limited utility in the study of natural cognition. To surmount this problem, we are devising a novel approach that enables the study of brain function during natural behavior. Our approach starts by recording complex patterns of brain activity during daily-life behavior with functional magnetic resonance imaging (fMRI). We then mine interesting patterns in the recorded data via a computational modeling approach. Leveraging this framework, we have recently demonstrated predictions of human brain activity during natural vision and visual search with unprecedented accuracy. In addition to advancing our understanding of sensory systems, these powerful models can enable sensitive assessment of cognitive deficits during early-stage disease progression.

Use of Connectivity Analysis in Disease Signature Extraction for Neurodegenerative Mental Disorders

Uğur Halıcı

Department of Electrical and Electronics Engineering, Middle-East Technical University, TR

Graduated from Dept. of EEE, Middle East Technical University (METU), Ankara, Turkey in 1980. Got her M.Sc and Ph. D. Degrees from the same department in 1983 and 1988 respectively. She is faculty member of Dept. of EEE METU and head of the METU-Hacettepe University joint Neuroscience and Neurotechnology Ph.D. program that she contributed to the establishment in 2014. Published two international edited books "Intelligent Biometric Techniques in Fingerprint and Face Recognition" by OCR press 1999 and "Innovations in ART Neural Networks" by Springer Verlag 2000, two national books, over 100 journal/conference papers. Her research interest covers Computer Vision, Machine Learning, 3D modeling, Pattern Recognition, Intelligent Systems and Computational Neuroscience. The research projects and graduate theses that she directed in computational neuroscience area include Disease Signature for Mental Disorders based on fMRI connectivity analysis, Brain Computer Interfaces for Silent Speech, Artificial Neural Networks, Deep Learning.

In medical science, it was always a question of whether patients can be diagnosed from healthy individuals or not. Over the years, neuroscientists attempted to find methods to

distinguish between patients with mental problems (Alzheimer, Schizophrenia, attention deficit disorder, obsessive compulsive disorder) and healthy people. The functional magnetic resonance imaging (fMRI) has received much attention in recent years and widely used in experiments to investigate the regions of the brain that have functional abnormalities of neural activity. Since the connectivity analysis provide information on functional and structural relationship between different regions of the brain, anomalies observed in the connectivity can be utilized for disease signature extraction for detection of mental disorders. In a recent study that we conducted in cooperation with Ankara University, Brain Research Center, we focused on discrimination of Obsessive Compulsive Disorder (OCD) and healthy cases using their functional connectivity and effective connectivity data obtained from fMRI. The detection of OCD is difficult using MRI or other conventional imaging techniques since they can only provide information for structural disorders and so they are not useful for detection of functional abnormalities especially in the early stages of the disease. However, we obtained quite successful results for automatic discrimination of OCD by applying machine learning approaches on fMRI connectivity data. These results encourage us for applying the methodology that we developed for OCD on other diseases such as Alzheimer or other neurodegenerative mental disorders and also to improve it by using novel machine learning approaches and novel imaging techniques.

Recent Developments in High Field MRS and Applications in Neurodegeneration and Psychiatric Diseases

Peter Barker

*Department of Radiology, Division of
Neuroradiology, Johns Hopkins University
School of Medicine, USA*

Peter Barker, D.Phil., is a Professor of Radiology and Oncology at the Johns Hopkins University School of Medicine in Baltimore, Maryland, USA. He has been active in magnetic resonance research for over 30 years, since starting his graduate studies on the development of techniques for high resolution NMR spectroscopy in Professor Ray Freeman's group in Oxford in 1982. After a post-doctoral fellowship at HMRI/Caltech, he moved to Johns Hopkins in 1989, where his primary research interest has been the development and applications of physiological MR techniques (in particular MRS and perfusion imaging) in neuroradiology.

Current research interests include developing methods to non-invasively map out neurochemical and neurotransmitter levels using MRS in patients with brain tumors, infectious, metabolic, neurodegenerative and psychiatric diseases. A particular focus is to develop human MRI and MRS techniques for use at high magnetic field strengths (7 Tesla).

MRS of the human brain is a mature technique, more than 25 years since its discovery, yet it continues to be an active area of research interest, both from a technical and clinical application point of

view. This presentation will review some recent developments in MRS of the human brain at high magnetic field strengths, and discuss applications to neurodegenerative and psychiatric diseases. Particular advantages at 7T compared to 3T include higher spatial resolution images, and better spectral resolution, particularly of compounds such as glutamate and glutamine. Abnormalities of the glutamatergic system may be of significance in numerous neuropathologies, for instance including schizophrenia or Huntington's disease. Approaches to some of the technical challenges of human 7T MRI/MRS will also be discussed.

MRS Biomarkers of Neurodegeneration: Considerations for Multi-site Trials

Gülin Öz

Center for Magnetic Resonance Research,
Department of Radiology, University of
Minnesota, USA

Gülin Öz, PhD, is Associate Professor of Radiology at the Center for Magnetic Resonance Research (CMRR), University of Minnesota. Following BS degrees in Physics and Chemistry at Bosphorus University and a PhD in Biochemistry at the University of Minnesota, she continued with postdoctoral training at the CMRR where she later joined the faculty. She was the first to utilize an extended neurochemical profile obtained by high field magnetic resonance spectroscopy (MRS) to assess cerebral changes in patients with a neurological disease (adrenoleukodystrophy) and their response to treatment. Since then, she focused her efforts on applications of advanced MRS methods in neurodegenerative diseases and diabetes. She recently coordinated a MRS consensus effort together with Dr. Risto Kauppinen to facilitate the use and standardization of robust MRS methodology in the clinical setting.

Clinical trials for neurodegenerative diseases are hampered by the lack of quantitative and objective biomarkers that reflect treatment effects in the brain. Proton magnetic resonance spectroscopy (¹H MRS) has potential to directly assess disease-modifying effects of therapeutic interventions in the brain since it provides a wealth of biochemical and metabolic information complementary to conventional structural

MRI. We have shown that MRS biomarkers reflect the clinical status, progression and reversal of pathology in hereditary movement disorders. In addition, we demonstrated that advanced MRS methodology implemented on a widely available clinical 3T scanner provides excellent reproducibility using standard equipment.

Standardization of robust data acquisition and analysis methods is particularly critical to fully benefit from the increased sensitivity and resolution at high and ultra-high fields. This presentation will share our experience in utilizing advanced MRS methodology in clinical populations, as well as in multi-center studies where in-house developed and optimized MRS methodology was implemented at multiple sites and within- and between-site reproducibility of neurochemical concentrations obtained using the methodology was investigated.

Fast Multi Nuclei MR Spectroscopic Imaging of Brain Lesions

Esin Öztürk Işık

Institute of Biomedical Engineering, Boğaziçi
University, TR

Esin Öztürk Işık, Ph.D. completed her Bachelor's studies in the Computer Engineering department of the Middle East Technical University in 1999. She attended the Biomedical Engineering program at the University of Alabama at Birmingham. She finished her thesis studies on the development of regularization methods for magnetic resonance imaging (MRI) data reconstruction under the guidance of Donald B. Twieg, Ph.D. and received her Master's degree from UAB in 2002. Thereafter, Dr. Öztürk Işık was admitted to the joint Bioengineering program between the University of California at Berkeley and the University of California at San Francisco. She joined the Margaret Hart Surbeck Laboratory of Advanced Imaging to work with Sarah J. Nelson, Ph.D. The goal of her thesis research was to implement several fast MRI and magnetic resonance spectroscopic imaging (MRSI) data acquisition and reconstruction techniques for faster and more accurate spectral quantification of brain tumors using the clinical 3T MR scanners. Dr. Öztürk Işık completed her Ph.D. studies in 2007 and continued her research as a postdoctoral fellow in the Radiology and Biomedical Imaging department at University of California at San Francisco. Her postdoctoral research studies included the implementation and optimization of higher resolution and sensitivity MRSI techniques on the whole body high field 7T MRI scanners. Dr. Öztürk Işık has been working as an

assistant professor at the Biomedical Engineering Institute of the Bogaziçi University since Fall 2014. The main aim of her projects has been developing novel molecular magnetic resonance imaging techniques to allow for a better understanding of underlying biochemistry of diseases in order to improve patient health.

Magnetic resonance spectroscopic imaging has been widely used in clinical settings to determine the underlying biochemistry of several brain disorders. Proton magnetic resonance spectroscopic imaging (1H-MRSI) is a noninvasive technique that can provide information about cell proliferation, energy metabolism and neuronal activity. Phosphorus magnetic resonance spectroscopic imaging (31P-MRSI) is another MR imaging technique that can provide in-vivo quantitative information about the energy metabolism, the oxygen state and the pH within a given region of interest. Phosphorus is fifteen times less abundant in tissue than proton, leading to a higher interest of proton MR spectroscopic imaging at low field strengths. In-vivo phosphorus MR spectroscopic imaging has recently become more popular with the availability of higher field strength MR scanners due to the increased signal to noise ratio and higher spectral peak separation. Despite the advancements, 31P-MRSI has not been widely used in the clinical settings due to the lack of phosphorus sensitive MR coils and the scan time limitations. In this talk, approaches for fast magnetic resonance spectroscopic imaging of brain lesions will be discussed.

The Reassessment of MRS as a Clinical Tool: The Impact of 32 Channel Head Coil and 3T

Alp Dinçer

Medical Faculty, Department of Radiology,
Acibadem University, TR

He was born In 1964, Nigde. He completed his undergraduate education in Ankara. In 1981, he began his medical education at Hacettepe University, School of Medicine. He graduated in 1988. In the same year he began working as a resident in Hacettepe University, School of Medicine, Department of Radiology. He graduated as a radiology specialist in 1992. Until 2003, he worked as a radiologist at a private clinic in Istanbul. Since 2004, he began working as a radiologist at Acibadem Kozyatağı Hospital. In 2009, he was appointed as Assistant Professor at Acibadem University School of Medicine, Department of Radiology. In 2011, he appointed as an Associate Professor in the same department.

the utility of high resolution single voxel proton spectroscopy in the evaluation of the brain disorders as a clinical tool using 3T and 32 channels head coil is assessed.

Proton magnetic resonance spectroscopy of the human brain has been possible for at least 25 years and has been readily available in the clinical arena for over half that time. The advantage of MR spectroscopy is that it is the only method which allows studying molecular structures in vivo, but, from the point of sensitivity it is one of the worst methods. Limited spatial resolution is one of the crucial factors limiting clinical application of MR spectroscopy. Moreover it is not a standard clinical tool yet. So, its clinical use as a routine part of the initial diagnostic examination for intracranial lesions has not been wide acceptance. In this presentation,

¹H-MR Spectroscopy of Focal Brain Lesions

Muhteşem Ağıldere

Department of Radiology, Başkent University,
TR

He was graduated from Hacettepe University Medical School in 1987. He finished his radiology residency in 1992 in the same University hospital. He had neuroradiology research fellowship in Johns Hopkins University between 1992-93 and clinical body fellowship in Cornell University between 1994-1995. He has been working in Baskent University Radiology Department, Ankara since 1995 and became professor in 2003 in the same department. He has attended as the chair of the department since 2011. He has been having different duties in Turkish Society of Radiology and Turkish Society of Magnetic Resonance (TSMR) since 2000 and acting as chair since 2014 in TSMR. He has more than 90 international publications with about 800 citations. He has many national and international presentations and scientific talks.

¹H-MRS by using CSI technique helps at the differential diagnosis of focal brain lesions, to identify the internal biochemical structure of the lesions, grading the tumor, to plan therapy and evaluate the recurrent or residual tumors. Conventional MR techniques may not be sufficient in many cases and ¹H MRS may become an important tool to diagnose or to plan the treatment. The main metabolites used in the identification of focal lesions are Cho, NAA, Cr, lactate and myo-inositol and their ratios.

Cerebral glioma grade evaluated by using normal side creatine as an internal reference in multivoxel H-MRS and using of normal side Cr as an internal reference provides a more objective evaluation for brain tumor grading. Data showed that Cr tended to be low in the high-grade tumors. In addition to conventional metabolite ratios, the Min-NAA/Cr ratio might be useful in brain tumor grading. Combined use of metabolite ratios might be helpful in grading brain tumors in cases without significantly increased Cho/Cr ratios.

In the second study the effects of interferon Beta 1 a on proton MRS in patients with MS was evaluated. In this study, the treated and untreated group of patients follow-up during 12 months by using Cho, NAA and Cr values. There were no significant differences in normal appearing white matter (NAWM) metabolite peaks of the control group and patients with MS. However, in white matter lesions and NAWM there was significant differences between the metabolic peaks ($p < 0.05$) in the treatment group although no differences demonstrated in the untreated group. These data suggest that INF β -1a has a favorable effect on restoration of metabolites in MS lesions.

Quantitative Susceptibility Mapping (QSM) in Neurodegeneration

Chunlei Liu

Radiology, Medical Physics, Biomedical
Engineering, Duke University, USA

Dr. Liu is an Associate Professor of Radiology and Biomedical Engineering at Duke University (Durham, North Carolina, USA). He obtained his Ph.D. degree in Electrical Engineering from Stanford University (Stanford, California, USA) and continued his postdoctoral training at Stanford University School of Medicine. He joined the faculty at Duke University in 2009. His current research focuses on developing MRI techniques and exploring their applications in neuroscience and medicine. He was a Young Investigator Award Finalist of the International Society of Magnetic Resonance in Medicine in 2007. In 2006, he was awarded the Pathway to Independence Award (K99/R00) by the US National Institutes of Health.

Quantitative susceptibility mapping (QSM) is a novel high resolution MRI technique for imaging and quantifying tissue magnetic susceptibility. Biological tissues such as those in the brain have varying values of magnetic susceptibility that originate from their molecular composition and microstructure. As a result, magnetic susceptibility provides an intrinsic mechanism for generating tissue contrast in MRI. Susceptibility quantification further provides a means to characterize tissue structure and function that may reflect changes in diseased brains. This talk will describe the basic principles and practical implementation of QSM, the biophysical

mechanisms behind tissue magnetic susceptibility and its emerging applications in imaging neurodegeneration both in normal aging and in various diseases and disorders.

MRI Acquisition & Processing Techniques to Study Neurodegeneration

L. Tugan Müftüler

Department of Neurosurgery, Medical
College of Wisconsin, USA

L. Tugan Muftuler, Ph.D. received his B.S. M.S. and Ph.D. degrees in Electrical and Electronics Engineering from the Orta Dogu Technical University (ODTU), Ankara, Turkey. In ODTU He was the team leader for building a home-made research MRI system. After he received his doctorate degree, he joined the Research Imaging Center at the University of California, Irvine and worked as a post-graduate researcher in the MRI research lab. There, he again became the team leader for building a 4T research MRI system. Later, he became an Assistant Researcher and then Assistant Professor until 2010 in the department of Radiological Sciences at UCI. In 2011, he moved to Milwaukee and became an Associate Professor in the Neurosurgery Department at the Medical College of Wisconsin. He is the author of 48 peer-reviewed articles, 81 peer-reviewed conference papers and holds patents on three inventions (three more pending). He also edited a book on Quantitative MRI techniques. His research interests include novel pulse sequence designs, RF coil designs and quantitative MRI techniques. In 2006, he received the first place award in engineering category at the ISMRM with his new approach for designing RF coils optimized for parallel imaging and later in 2014 he received the first place award in the musculoskeletal imaging category with his novel spine imaging approach.

L.Tugan Muftuler is a member of the Institute of Electrical and Electronic Engineers (IEEE), the American Association of Physicists in Medicine (AAPM), the International Society of Magnetic Resonance in Medicine (ISMRM) and AOSpine society.

The ability to study the whole brain in vivo using advanced imaging instruments, acquisition techniques and analysis methods enabled us to investigate brain structure and function with ever more precision. Such methods gave us the ability to detect subtle changes in the brain with high specificity and, therefore, they have come to play a key role in understanding the basis of brain abnormalities in several neurocognitive diseases. For instance, changes in cerebral cortex and subcortical structures became possible with high resolution T1 weighted MRI scans and advanced analysis tools such as FreeSurfer and FSL. Using these tools, atrophy of the cortical and subcortical structures have been demonstrated in early stages of dementia and Alzheimer's Disease (AD). Similarly, conventional and advanced diffusion MRI techniques afforded us to study brain microstructure in vivo, demonstrating us subtle changes in brain white matter in AD. In this talk, I am going to discuss such MRI acquisition and data analysis techniques that we used to study neurodegeneration, particularly AD. In parallel, I will also review some of the recent literature in this field.

Integrated PET-MR Scanners and Their Applications

Azim Çelik

GE Healthcare, TR

Azim Çelik was born and raised in Turkey. Following his graduation from the Electrical Engineering Department of Dokuz Eylül University in Izmir (Turkey) in 1992, he moved to United States to pursue graduate studies. He did his research at Prof. Mark Haacke's Lab with Dr. Weili Lin and graduated from Washington University in St. Louis, Missouri in year 2000 with a PhD in Electrical engineering. He, then, worked at General Electrical Healthcare headquarters in Waukesha, Wisconsin as pulse sequence development engineer until 2003 and moved back to his home country later that year. He currently works as an MR clinical scientist in a region covering Russia, Middle East, Africa, Central Asia, Turkey and Eastern Europe. He authored or co-authored 24 articles, 60 abstracts and 2 books.

Magnetic Resonance (MR) is an excellent modality for anatomical and functional imaging. On the hand, Positron Emission Tomography (PET) enables visualization of cellular and metabolic activity. Integrated multimodality systems such as PET-SPECT and PET-CT have been proven to be a very valuable tool for clinical application and make it possible to visualize spatial and pathological correlation of abnormal metabolic activity. More recent development for the integrated PET and MR systems brings together two very powerful imaging modalities both for clinical application and

research.

The integrated PET-MR systems have significant potential for clinical applications especially in Neuro imaging. It also has significant potential for neurogenerative diseases. The new generation PET-MR scanners are equipped with MR compatible silicon photomultiplier detectors (SiPM) technology. The new digital detector technology has a marked increase in sensitivity compared to conventional PET scanners (up to three times) and also has a fast coincidence timing resolution enabling TOF reconstruction. TOF technology allows detecting the arrival time of each pair of coincident more precisely, resulting in higher PET resolution.

The purpose of this talk is to give an overview of new generation integrated PET-MR technology and share its applications on neuro imaging.

High-Resolution Diffusion MRI / Magnetic Particle Imaging

Emine Ülkü Sarıtaş

UMRAM, Bilkent University, TR

Asst. Prof. Emine Ulku Saritas graduated with B.S. degree in Electrical and Electronics Engineering from Bilkent University in 2002. She was awarded the Lucent Technologies Stanford Graduate Fellowship for her graduate studies at Stanford University, at the Department of Electrical Engineering. There, she received her M.S. and Ph.D. degrees in 2004 and 2009, respectively. During her Ph.D., she worked on high-resolution diffusion-weighted Magnetic Resonance Imaging (MRI) of targeted regions, under the supervision of Prof. Dwight G. Nishimura at the Magnetic Resonance Systems Research Lab (MRSRL) of Stanford University. She then joined the Department of Bioengineering at University of California, Berkeley as a Siebel Stem Cell Institute Postdoctoral Fellow. During her postdoctoral research between 2010-2013, she worked with Prof. Steven M. Conolly on Magnetic Particle Imaging (MPI) systems. Dr. Saritas has joined Bilkent University's Department of Electrical and Electronics Engineering in September 2013. She is the recipient of the 2015 "Young Scientist Outstanding Achievement Award" (GEBIP), given by the Turkish Academy of Sciences (TÜBA).

essential for the diffusion-weighted imaging (DWI) of small structures. This talk will present advanced pulse sequence methods to overcome the problems associated with and enable high-resolution diffusion MRI of targeted regions. In addition to validating the performance of the proposed methods outside the central nervous system, example cases from an extensive clinical evaluation of the high-resolution diffusion MRI of spinal cord will be presented.

Recently, a new imaging modality called Magnetic Particle Imaging (MPI) is also being considered as a potential tool for measuring local diffusivity. MPI exploits the nonlinear response of super-paramagnetic iron oxide (SPIO) nanoparticles to oscillating magnetic fields, and generate an image of the spatial distribution of these nanoparticles. The potential applications of MPI range from in vivo stem cell tracking to angiography. The signal from these SPIO nanoparticles, however, is also sensitive to the properties of the local environment, such as temperature and viscosity. The second part of this talk will explore the potential of MPI for measuring local diffusivity in vivo.

Diffusion-weighted MRI provides information about random microscopic motion of water molecules in biological tissues. While high in-plane resolution is desirable for all MRI applications, it is particularly challenging and

Medical Device Advances in Interventional MRI

Özgür Kocatürk

Institute of Biomedical Engineering, Boğaziçi
University, TR

Dr. Özgür Kocatürk was graduated from Boğaziçi University, Department of Physics in 1999. He received his MSc. and Ph.D. Degree in Institute of Biomedical Engineering from Boğaziçi University in 2002 and 2009 respectively. During and after his Ph.D., he had been working as a staff scientist at National Heart Lung and Blood Institute of National Institutes of Health in Maryland, U.S.A between 2004 and 2012. He has been working as an assistant professor at the Institute of Biomedical Engineering, Bogazici University since 2012. He has been awarded National Institutes of Health Merit Award (2009), NIH Orloff Science Award (2013) and National Science Academy Young Scientist Award (2014). His main research areas are; Biomaterials, intravascular devices and implants designed for interventional magnetic resonance imaging (MRI), radio frequency safety under MRI, catheter robotics, micro electro mechanical systems (MEMS).

Magnetic Resonance Imaging has proven to be a versatile noninvasive cardiovascular imaging tool due to its lack of ionizing radiation nature and multi-plane soft tissue imaging capability. These strengths make MRI appealing to guide intravascular device-based cardiovascular disease treatments. The interventional cardiovascular MRI (icMRI) aims to improve the safety and efficacy of conventional applications routinely

performed under fluoroscopy and also to enable novel applications that are not possible under radiographic guidance.

icMRI requires rapid real time imaging because of the need for fine catheter manipulation while acquiring cardiac motion. MRI scanner hardware improvements such as more homogenous magnetic field and rapid switching magnetic gradients and more efficient pulse sequences such as steady-state free precession (SSFP) provides imaging rates exceeding 10 frames per second on clinical 1.5 T scanners. However, icMRI suffers from dedicated interventional devices because commercially available devices either undergo undesired mechanical displacement due to ferrous components or largely invisible under MRI. Also, the interventional devices incorporating long conductors possess radio frequency (RF) induced heating risk during their use under MRI. In this talk, I will introduce several “active” and “passive” device designs that address both MRI visibility and safety concerns and also present related clinical applications.

An Early Registration Method for Group Tractography

Aziz Uluğ

Center for Neurosciences, Feinstein Institute
for Medical Research, USA

Aziz M. Uluğ, PhD, is Associate Investigator in the Center for Neurosciences and serves as Director of MRI Research. He also leads the Imaging Core (MRI) for the National Institutes of Health Morris K. Udall Center of Excellence in Parkinson's Disease Research. Dr. Uluğ's research work focuses on neuroimaging applications of MR diffusion tensor imaging (DTI). He is also highly experienced in other functional applications of MRI, such as functional MRI (fMRI) and MR spectroscopic imaging (MRSI), and has published more than 70 manuscripts during his career.

Dr. Uluğ earned his PhD in Solid State NMR (nuclear magnetic resonance) from Washington University in St. Louis in 1993. After completing a postdoctoral fellowship with the Department of Radiology at Johns Hopkins University, in 1997, he joined Weill Cornell Medical College as Assistant Professor in the Department of Radiology; in 2003 he was made Associate Professor. Dr. Uluğ joined the Functional Brain Imaging Laboratory at the Feinstein Institute in 2008.

In DTI experiments, tensor derived parameter maps are usually registered to a common template in order to do group analysis. Tractography on the other hand, are usually done in the native space of the patients. Having a method to do tractography in the common space may have useful applications.

We describe an early registration method to do group tractography which has also improved contrast and signal to noise characteristics in tensor derived parameter maps. In this method, all diffusion-weighted images are registered to a common template and gradient vectors are reoriented for each subject. These images are then combined into a super set before tensor calculation. The super set includes all images from all subjects. Validity of this method is shown in human and animal models of dystonia. Additional applications in other diseases are also discussed. We expect the analysis of differences in group level white matter tracts and fractional anisotropy maps will be useful in understanding the pathophysiology of various non-focal white matter diseases.

Characterizing Diffusion Anisotropy with a Stiffness Tensor

Evren Özarslan

Department of Physics, Boğaziçi University,
TR

Evren Özarslan is an assistant professor in the Department of Physics at Boğaziçi University. Prior to joining Boğaziçi University, Dr. Özarslan was an Assistant Professor at Harvard Medical School. He performed research at Brigham and Women's Hospital as a research associate and the Section on Tissue Biophysics and Biomimetics, National Institutes of Health first as a postdoctoral fellow, then as a scientist with the Center for Neuroscience and Regenerative Medicine. He obtained his B.S. degree in Physics from the University of Illinois, Urbana-Champaign. Then he continued his education at the University of Florida where he received his M.S. degree in Biomedical Engineering as well as Ph.D. in Physics. Dr. Özarslan's current research is on modeling diffusion in biological tissue and other porous media with the aim of characterizing the microstructure of the specimen using magnetic resonance techniques.

Translational diffusion of fluids can be observed by introducing magnetic field gradient waveforms into nuclear magnetic resonance (NMR) acquisitions. We studied the influence of diffusion on NMR experiments when the diffusing molecules are subjected to a force field. We place special emphasis on parabolic (Hookean) potentials, which we tackled theoretically using path integral methods. We obtained

explicit relationships for commonly employed gradient waveforms involving pulsed and oscillating gradients. Semi-analytical multiple correlation function (MCF) method as well as random walk simulations validated our theoretical results.

The three-dimensional formulation of the problem leads to a new characterization of diffusional anisotropy. Unlike for the case of traditional methods that employ a diffusion tensor, anisotropy in our model originates from the stiffness tensor while bulk diffusivity is retained in the formulation. Our approach thus yields an expansive alternative to diffusion tensor imaging (DTI). Contrary to DTI, our technique accounts for the non-Gaussianity of the diffusion process as reflected in its different diffusion-time dependence, which is more suitable for realistic problems.

Post-Analysis Techniques for Diffusion MRI in Neuroimaging

Gözde Ünal

Faculty of Computer Engineering and
Informatics, Istanbul Technical University, TR

Dr. Gozde Unal received her Ph.D. degree from ECE Department of North Carolina State University in 2002. She held research faculty and research scientist positions at Georgia Institute of Technology in 2002–2003, and at Siemens Corporate Research, Princeton, NJ, in 2003–2007, respectively. She was an assistant professor (2007–2011) and an associate professor at Sabanci University (2011–2015). Currently, she is an associate professor at the Department of Computer Engineering, Istanbul Technical University. Her research interests are in computer vision, segmentation, registration, and shape analysis techniques with applications to medical imaging.

In this talk, I will present two novel techniques for processing of diffusion MRI data. First technique consists of an effective regularization technique for capturing inherent asymmetry of the underlying intravoxel geometry that exists in bending, crossing or kissing fibers of the brain white matter. This, to our knowledge, is the first study that demonstrates the asymmetry at the voxel level. Second technique provides a first automatic approach to labeling of five of the major brainstem and cerebellar white matter pathways, which are involved in critical in sensorimotor functions as well as

higher cognitive functions of the brain.

Brain Network Analysis

Burak Acar

Department of Electrics and Electronics
Engineering, Boğaziçi University, TR

Dr. Acar received his BS, MS and PhD degrees, all in electrical and electronics engineering, from Bilkent University, Ankara, Turkey, in 1994, 1996 and 2000 respectively. His PhD thesis was on Electrocardiogram (ECG) signal processing and analysis, during which he spent a year at UCL, St. George's Hospital Medical School, Dept. of Cardiac and Vascular Sciences, London, UK. He worked at Stanford University Medical School, Dept. of Radiology, 3D Lab., CA, as a post-doc researcher on CT Colonoscopy and DTI processing, before joining Bogazici University, Electrical and Electronics Eng. Dept, in 2003. He spent a year at TU Munich, Germany, between 2012-2013, as a Mercator Visiting Professor. His current research interests are brain network analysis, semantic analysis of medical images for search and retrieval, US simulations and multi-dimensional data analytics in general.

Dr. Acar is the recipient of the Excellence in Research Award from Bogazici University Foundation (2006) and the Young Researcher Award from Turkish Academy of Sciences (2008).

Brain has been known to be a network for over a hundred years, yet the network based analysis of brain (dys)function has recently gained pace as a result of technological advances in physiological signal monitoring and brain imaging. Structural and functional network models of the brain have been

shown to demonstrate characteristic properties and several network parameters were shown to have clinical correlates. Despite the unprecedented progress in the field, much of the current methods used are under debate as no standard approach has been established yet. This talk is aimed at providing a brief overview of brain's structural and functional network modeling approaches and highlighting the points where the researchers should take care while designing their research methodology.

Continuous Monitoring PD patients in Daily Living Environments Using Wearable Sensors

Cem Ersoy

Department of Computer Engineering,
Boğaziçi University, TR

Cem Ersoy worked as an R&D engineer in the Northern Telecom subsidiary NETAS A.S. between 1984 and 1986. After receiving his PhD from Polytechnic University, New York in 1992, he became a professor and department head of Computer Engineering in Bogazici University. Together with Prof. Çağlayan, he established the Computer Networks Research Laboratory, NETLAB (<http://netlab.boun.edu.tr>). Today, with its 90 members, NETLAB is the largest research group in Turkey in that field. In 1999, Prof. Ersoy established the Wireless Sensor Networks Research Group WiSe (<http://netlab.boun.edu.tr/WiSe>). Currently, WiSe has around 20 graduate and 5 undergraduate students.

Prof. Ersoy guided 65+ graduate students, authored 200+ scholarly papers. As of October 2015, he has received 990+ citations in the Web of Knowledge and his h-index is 14. He has received 3970+ citations in Google Scholar and his h-index is 25.

Prof. Ersoy's 30+ completed and continuing projects are funded by: 5 of them European Union, 4 of them TÜBİTAK fund, 4 of them State Planning Organization, 3 of them by the private sector in the BU Teknopark, 15 of them by the BU Research Fund.

Prof. Ersoy's research interests include wireless/cellular/adhoc/sensor networks,

activity recognition and ambient intelligence for healthcare applications, crowdsourcing applications, collaborative urban sensing with smartphones and green network design, smart grid communications, mobile cloud/edge/fog computing, software defined networking, infrastructureless communications for emergency scenarios and intelligent transportation applications.

Prof. Ersoy is the Vice Director of the Telecommunications and Informatics technologies Research Center, TETAM (<http://tetam.boun.edu.tr>). TETAM is supported by the Ministry of Development, funding the largest PhD student body in Turkey in that field. Prof. Ersoy is a member of IFIP and the chairman of the IEEE Communications Society Turkish Chapter.

Motor dysfunctions resulting from neurodegenerative diseases, such as Parkinson's Disease (PD), have a direct adverse effect on the patients' quality of life. Treatment methods, especially drug therapy, are effective for mitigating the symptoms, even though they do not alleviate the actual progression of the disease. However, for the drug therapy to be effective, it has to be personalized, which may only be possible if the severity and the state of the disease are known. The motor symptoms, presented on a wide spectrum, may vary from patient to patient. Some symptoms are observed depending on the specific context or the activity of daily living being performed; hence the diagnosis of all the symptom variations is not possible solely by clinical observations. Such characteristics of PD require patients to be monitored for prolonged periods of time

and in daily living settings, to enable accurate diagnosis and efficient treatment. Complications resulting from the wrong drug dosage adjustment may be confused with Parkinsonian symptoms, thus necessitating an objective evaluation of the actual effects of the drug. Wearable sensors have become viable monitoring tools for health-care applications, due to their decreasing size and cost. Considering the motor characteristics of the Parkinsonian symptoms, inertial measurement units (IMU), composed of accelerometer, gyroscope and magnetometer sensors, have become serious alternatives for the monitoring and analysis of these symptoms. Such a system may be employed for the detection and analysis of tremor and gait abnormalities, both of which are cardinal symptoms of PD. We utilize machine learning methodology to process the data collected via IMUs, in order to make inferences on the existence and the severity of the symptoms. Such a system has the potential to enable the clinicians to observe their patients in daily living settings, and come up with long-term, automated and objective analysis of the symptoms.

Fusion of Facial Expression Images with EMG Recordings to Determine the Level of Bradykinesia in Parkinson's Disease

Didem Gökçay

Institute of Informatics, Middle-East Technical
University, TR

Didem Gökçay graduated from Department of Electrical Engineering of Middle East Technical University with BS and MS degrees; Department of Computer and Information Sciences of University of Florida with PhD. She has worked as a research fellow at University of Florida McKnight Brain Institute and University of California San Diego. At the present, she is an assistant professor at the Health Informatics department of Informatics Institute, under Middle East Technical University. She is a two time recipient of Fulbright scholarship. She is currently on leave conducting research at the Radiology and Imaging Sciences department of Emory University. Her research interests center on the interplay between emotion and cognition, surpassing a series of measurement tools involving MRI, fMRI, eye tracker recordings.

validate the results with UPDRS scores. For this purpose, in-house hardware and software are developed for simultaneous recording and analysis of facial expressions as well as EMG from corrugator and zygomatic muscles. Typical movements such as frown, smile and lip puckering are evaluated to determine whether muscle activity and facial movement are correlated with UPDRS, a measure which clinicians rely on.

One of the classic symptoms of Parkinson's Disease is bradykinesia: excessive slowness of motor movement. Lack of facial expressions is a common complaint among patients and caregivers which effects the quality of life of PD patients. While characterization of PD is being done with UPDRS scores, a comparison of facial movement with muscle activation and UPDRS is lacking. This study aims to quantify bradykinesia through fusion of facial expression images, EMG recordings and to

Traumatic Brain Injury-Induced Neuroendocrine Changes

Fahrettin Keleştemur

Department of Internal Medicine, Erciyes
University, TR

He graduated from the School of Medicine, Hacettepe University, Ankara/Turkey in 1979. After completing his residency in 1984 at the Department of Internal Medicine, School of Medicine, Erciyes University, Kayseri/Turkey, he became an assistant professor in 1988, and he continued his training in endocrinology at the Department of Endocrinology, Medical School (Cerrahpaşa), Istanbul University/Istanbul, and he worked at the Department of Endocrinology at St Bartholomew's Hospital, London/UK. In 1990, he became an associate professor, and he became a professor in 1995. Prof. Keleştemur, whose main fields of interests are neuroendocrinology, reproductive endocrinology and pituitary, has focused especially on traumatic brain injury-induced neuroendocrine changes in recent years. Keleştemur and co-workers first described neuroendocrine changes in boxers and kickboxers.

He is the editorial board member of the following scientific journals: Growth Hormone and IGF Research, Experimental and Clinical Endocrinology and Diabetes, Expert Review of Endocrinology and Metabolism, World Journal of Diabetes, Hormones Journal, Endocrine, Clinical Endocrinology, Frontiers in Pituitary Endocrinology, British Journal of Medicine and Medical Research, BMC Endocrine Disorders. He was invited as a visiting professor to Trier University

(Germany), Radcliffe Infirmary (Oxford/UK), and to the Department of Endocrinology, Cleveland Clinic (USA). He was an Executive Committee member of the European Neuroendocrine Association (ENEA) in 2004-2006 and of the European Society of Endocrinology (ESE) in 2005-2009. He was a Teaching Committee Member of ESE (2008-2012) and is currently an Advisory Board Member of European Neuroendocrine Tumor Society (2006-2015). In addition, he has been a member of the PCOS Special Interest Group since 2013. He has been a Board Member of Pituitary Society in 2015. He was the President of Erciyes University between 2008 and 2015. He has been appointed as the President of the Health Institute of Turkey (HIT) in 2015. He is the past president of the Society of Endocrinology and Metabolism of Turkey (SEMT/2006-2008). He has been a member of the Turkish Academy of Sciences (TUBA) since June 9, 2012.

His main scientific awards are as follows: Lilly-Mustafa Nevzat 1992 Diabetology Award, The Society of Endocrinology and Metabolism of Turkey / Scientific Award 2008, British Society for Neuroendocrinology/ BSN 2011 Award, Bayındır Health Group 2013 Scientific Award, TÜBİTAK (The Scientific and Technological Research Council of Turkey) 2014 Scientific Award. He has given nearly 70 lectures as an invited speaker in various international conferences up to now. He is the author of 212 articles published in various international journals.

Traumatic brain injury (TBI) is a common public health problem worldwide, which gives rise to increased morbidity and mortality. It is

also the leading cause of physical and psychological disability. Although pituitary dysfunction due to TBI was first described 95 years ago, only a few papers have been published in the literature until 2000. Recent studies have revealed that TBI is one of the common causes of hypopituitarism. TBI may be characterized by a single head injury such as from a fall or by chronic repetitive head trauma as seen in combative sports including boxing and football. Vascular damage, direct trauma, genetic predisposition and autoimmunity may have a role in the development of TBI-induced pituitary dysfunction. Because of the special anatomical location of anterior pituitary cells and their blood supply, GH is the most commonly lost hormone in TBI victims. Interestingly, pituitary volume was found as smaller in retired boxers with GH deficiency when compared to retired boxers with normal pituitary functions and to normal subjects. Hypopituitarism after TBI remains undiagnosed and therefore untreated in most patients because of the non-specific and subtle clinical manifestations. Treatment in patients with TBI-induced hypopituitarism depends on the deficient anterior pituitary hormones. GH replacement therapy has some beneficial effects on metabolic parameters, attention deficits, impulsions impairment, depression, sleep abnormalities, and cognitive disorders. If the treatment of hypopituitarism is neglected, it would be expected that underlying hypopituitarism would aggravate the clinical picture of TBI itself. Therefore, the diagnosis and treatment of unrecognized hypopituitarism due to TBI are crucially important not only to decrease morbidity and mortality due to hypopituitarism but also to alleviate the chronic consequences due TBI.

TRANSPORTATION BY BUS (İETT)

From Kadıköy - 14R KADIKÖY RASATHANE

Bus stop: ***Yalnız Selvi Caddesi***

From Üsküdar - 15R ÜSKÜDAR RASATHANE

Bus stop: ***Yalnız Selvi Caddesi***

TRANSPORTATION BY MINIBUS

The TALİMHANE - RASATHANE minibuses (blue) departing right across from the Beşiktaş boat pier at Üsküdar follow the same route as the 15R busses.

TRANSPORTATION BY METROBUS

Get off at the stop Boğaziçi Köprüsü, which is the first stop after crossing the Bosphorus Bridge, then leave the highway by taking the stairs to the lower road, and go towards the Beylerbeyi Palace. At Tünel bus stop take a bus (15R) or a minibus (TALİMHANE - RASATHANE).

Boğaziçi University, Kandilli Campus Map



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Organization for
Human Brain Mapping

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