Shahid Beheshti University

انجمن علوم و فن آوری های شناختی ایران
Iranian Society for Cognitive Science & Technology

IHBM 2020

7th Iranian Human Brain Mapping Congress (Virtual)

9-12 November 2020

۱۹ تا ۲۲
آبان ماه ۱۳۹۹

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Wellcome Message

Mojtaba Zarei
MD, PhD, FRCP (UK)

Dear colleagues,

It is a pleasure to welcome you to the 7th Iranian Human Brain Mapping Congress held at Shahid Beheshti University. Shahid Beheshti is the fastest growing university in Iran with emphasis on human resources and new technologies and/as well as one of the major centers and pioneers of brain mapping science in Iran. Interest in Brain Mapping has grown considerably since we started this annual meeting. Given the interdisciplinary nature of brain mapping science, each year we welcome scientists with different backgrounds including neuroscience, medical sciences, bioengineering, mathematics, biophysics, psychology, computer science, etc. It has become the highlight of our activity when students and senior researchers, clinicians, and scientists, policymakers and policy users are all getting together to discuss new findings and advanced technologies in the field of brain sciences. Our main endeavor is for the younger generation to get inspired by those who dedicated their lives to the advancement of science to alleviate human suffering. This year we continue our slogan:" Brain Mapping: From Molecule to Medicine". We are aspiring to provide a medium for both domestic and world-renowned scientists to discuss and collaborate to obtain a better understanding of the nervous system and the related diseases. If brain mapping has taught us only one thing, that would be the importance of networks for optimal functioning. For this reason and many more, we welcome international scientific collaboration. Iran has so much to offer in neuroscience in general, and brain mapping in particular. There is a wealth of talent and energy among our educated youth which should be put into good causes with appropriate mentorship and guidance. In recent years, many high-quality clinical types of research have been published in prestigious medical journals because of access to a wide range of patients and their keen participation in research. We hope that this can be extended into clinical neuroscience as well. I encourage you to engage with our participants to develop your line of contact and to establish new networks to enhance your research. If there is anything that I can do to help, do not hesitate to contact me. I hope you enjoy the program and social interaction.

Mojtaba Zarei
Program Chair of IHBM 2020

Panel	Monday (9th November)	Tuesday (10th November)	Wednesday (11th November)	Thursday (12th November)	13th November
	Neurology & Pain	Psychiatry & Neurocognitive Disorders	Neurosurgery	Psychiatry & Sleep	Workshop
9-10	***Welcome*** Citations from Quran National Anthem **Mojtaba Zarei** (Director of IMSAT) **Saadolah Nasiri Gheydari** (Chancellor of SBU) **Alireza Zali** (Chancellor of SBMU)	-	-	-	***Dynamic Causal Modelling for Resting State fMRI workshop*** Adeel Razi
10-11	***Keynote talk:*** **Tor Wager (Dartmouth College):** Neuroimaging of pain and emotion: Representation, biomarkers, and interventions	***Keynote talk:*** **Peter Kochunov (University of Maryland):** Reshaping psychiatry using big data studies	**Saeed Oraee Yazdani (Shahid Beheshti University of Medical Sciences):** Application of brain mapping in brain tumor surgery	***Keynote talk:*** **Kai Spiegelhalder (University of Freiburg):** Neuroimaging insights on insomnia disorder	
11-11:30	**Ashkan Mowla (University of Southern California):** Unruptured brain aneurysm: a ticking time bomb or don't worry, be happy	**Martine Hoogman (Radboud University):** Looking at the ADHD brain from multiple angles	**Masoumeh Najafi (Iran University of Medical Sciences):** Organ-at-risk-sparing 3D radiotherapy planning supported by brain mapping	**Govinda Poudel (University of Sydney):** Sleeping while awake: Functional neuroimaging of behavioural microsleeps	
11:30-12	**Ali Khatibi (University of Birmingham):** Cerebrospinal Imaging: Understanding pain processing and motor learning in human	**Tim Silk (Deakin University):** Fibre specific white matter tract profiles of children with ADHD	**Sajad Shafiee (Mazandaran University of Medical Sciences):** Application of brain mapping in seizure surgery	**Andrew Bagshaw (University of Birmingham):** Multimodal neuroimaging in sleep and epilepsy	
12-12:30	**Shahabeddin Vahdat (University of Florida):** Functional neuroimaging of the spinal cord and brain circuits	**Manouchehr Vafaee (University of South Denmark):** Dopaminergic, serotonergic neurotransmission, glucose metabolism, and dendritic spines densities in the pathogenesis of Autism Spectrum Disorders	**Amin Jahanbakhshi (Iran University of Medical Sciences):** Application of brain mapping in functional neurosurgery	**Masoud Tahmasian (Shahid Beheshti University):** Sleep and neuroimaging, a need for a large collaboration **Fateme Samea (Shahid Beheshti University):** ADHD and sleep disturbance: the role of intrinsic brain networks	
12:30-13	Break-Time				
13-13:30	**Lorenzo Pasquini (University of California San Francisco):** Frontotemporal dementia, dynamic connectivity, and psychedelics: distinct windows on salience network function	**Narges Radman (Institute for Research in Fundamental Sciences):** Bilingual advantage on cognitive control: Does it really exist?	**Students' Poster Presentation**	**Closing Session**	
13:30-14	**Behrooz Yousefi (Philipps University of Marburg):** Pitfalls and advances in developing PET tracers for neurodegenerative disorders diagnosis neuroimaging	**Ladan Ghazi Saidi (University of Nebraska at Kearney):** Neural correlates of language processing in bilinguals: a dynamic system levered by language proficiency and language distance			
14-14:30	**Massih Moayedi (University of Toronto):** The neural mechanisms of temporomandibular disorders: insights from structural and functional MRI.	**Mohammad Shahdloo (University of Oxford):** Mapping language representation in the brain via deep models	***Multi-Variate Pattern Analysis In Human Brain Mapping Symposium*** Tijl Grootswagers, Jade Jackson, Maryam Vaziri-Pashkam, Hamid Karimi-Rouzbahani	***Effective CV Writing and Professional Interview Workshop*** Ali Khatibi, Masoud Tahmasian	
14:30-15	Break-Time				
15-15:30	**Ali Mazaheri (University of Birmingham):** The potential of brain rhythms to gauge the resiliency and vulnerability of an individual to mental illness.	**Adeel Razi (Monash University):** Causal models of brain function			
15:30-16	**Hasti Shabani (Shahid Beheshti University):** Spatial Resolution and Neuroimaging	**Sara Genon (Jülich Research Center):** Beyond performance in building predictive models of behaviour from resting-state functional connectivity: a focus on interpretability and sociodemographic factors			
16-16:30	**Amir H. Omidvarnia (Center for Neuroprosthetics, EPFL):** Temporal complexity of resting state fMRI is reproducible and correlates with higher order cognition.	**Sofie Valk (Jülich Research Center):** Genetics and phylogenetic factors underlying topological organization of cortical structure			
16:30-17	Break-Time				
17-18:30	**Students' Oral Presentations**	**Q & A session**			

Program Organizers

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Ladan Ghazi Saidi

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The MARCS Institute for Brain, Behaviour and Development, Western Sydney University, Australia

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Ali Mazaheri

School of Psychology, University of Birmingham, UK

Massieh Moayedi

Faculty of Dentistry, University of Toronto, Canada

Ashkan Mowla

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Amir Omidvarnia

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Lorenzo Pasquini

UCSF Weill Institute for Neurosciences, University of California, San Francisco, USA

Govinda Poudel

Mary MacKillop Institute for Health Research, Australian Catholic University, Melbourne, Australia

Narges Radman

Institute for Research in Fundamental Sciences (IPM), Tehran, Iran

Adeel Razi

Turner Institute for Brain and Mental Health, Biomedical Imaging Monash University, Melbourne, Australia

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Hasti Shabani

Institute of Medical Science and Technology, Shahid Beheshti University, Tehran, Iran

Mohammad Shahdloo

Researcher at the MR Physics Group at FMRIB Centre, University of Oxford

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Sofie Valk

Institute of Neuroscience and Medicine, Research Center of Jülich, Germany

Speakers

Maryam Vaziri Pashkam

Laboratory for Brain and Cognition, National Institute of Health, USA

Tor Wager

Department of Psychological and Brain Sciences, Dartmouth College, Hanover, NH, USA

Symposium

Multivariate Pattern Analysis in Human Brain Mapping	
Date	**Lecturer**
11 November 2020	Tijl Grootswagers Jade Jackson Hamid Karimi Rouzbahani Maryam Vaziri Pashkam

Workshops

Effective CV Writing and Professional Interview for an Academic Position	
Date	**Lecturer**
12 November 2020	**Ali Khatibi** University of Birmingham **Masoud Tahmasian** Shahid Beheshti University

Advanced Topics In Dynamic Causal Modeling	
Date	**Lecturer**
13 November 2020	**Adeel Razi** Monash University, Melborn, Australia

Sponsors

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Iranian Society for Cognitive Science & Technology

Center of Excellence in Cognitive Neuropsychology 2019

قطب علمی عصب روانشناسی شناختی ۱۳۹۸

Maghz Negar Pars

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Iranian Society for Cognitive Science & Technology

Shahid Beheshti University

Symposium
Multivariate pattern analysis in human brain mapping

11 November 2020

How multivariate pattern analysis can be used to study different aspects of human cognition

زمان: ۲۱ آبان ماه ۱۳۹۹

Tijl Grootswagers
Vice Chancellor's Research Fellow, The MARCS Institute for Brain, Behaviour and Development, Western Sydney University, Australia

Jade Jackson
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Hamid Karimi-Rouzbahani
Newton International Fellow, MRC Cognition and Brain Sciences Unit, University of Cambridge, UK

Maryam Vaziri-Pashkam
Research Fellow, Laboratory for Brain and Cognition, National Institute of Health, USA

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Iranian Society for Cognitive Science & Technology

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How to write a scientific CV and personal statement?

Workshop
12 November 2020
۲۲ آبان ماه ۱۳۹۹

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برای ثبت نام و اطلاعات بیشتر به سایت همایش مراجعه کنید.

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انجمن علوم و فن آوری های شناختی ایران
Iranian Society for Cognitive Science & Technology

Advanced Topics in Dynamic Causal Modeling Workshop

13 November 2020

Adeel Razi
Associate Professor of Psychology
Turner Institute for Brain and Mental Health,Biomedical Imaging Monash University, Melbourne, Australia

برای ثبت نام و اطلاعات بیشتر به سایت همایش مراجعه کنید.

۲۳ آبان ماه ۱۳۹۹

7th Iranian Human Brain Mapping Congress (Virtual)

هفتمین همایش نقشه برداری مغز ایران (مجازی)

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ABSTRACTS

Abstract No. 101

Alteration of Intrinsic Brain Networks in Insomnia disorder

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Introduction

Insomnia disorder (ID) is a common psychiatric disorder in which the patient cannot easily get to sleep or stay asleep. ID is associated with aberrant mental functions [1]. However, the pathophysiology of ID is not clear [2, 3]. In this study, we applied independent component analysis to resting-state fMRI data to identify potential brain network alterations in patients with ID compared to healthy subjects.

Methods

We recruited 52 healthy controls and 42 ID patients (aged 21-68 years; F/M ratio~=2) recruited from the Sleep Disorders Research Center, in the Kermanshah University of Medical Sciences. The diagnosis was performed by the international classification of sleep disorders, version 3. The preprocessing stages applied on the subjects include brain extraction, gray matter segmentation, applying a 100-frequency high-pass filter, motion correction using MCFLIRT, spatial smoothing, and finally registration to the 2mm MNI standard space, using FSL V6.00. Next, using the FSL V6.00 MELODIC tool, the group-ICA algorithm was applied to all the data. Then, we performed dual-regression to the ICA results in algorithm in order to back project the group ICA results to the subject level, and also comparing each ICA component in group level with related subject-level component between the healthy and ID patients' groups using permutation testing.

Results

We identified 11 independent components. Back projecting the group ICA into the subject level, and comparing every component in group level with that of the subject level, five components were significantly different between patients and controls. In particular, we found decreased functional connectivity in the visual networks, mainly in the supracalcarine, intracalcarin, parietal operculum, and supercarcarine, and was increased functional connectivity in the left somatosensory network in the patient group compared to healthy subjects ($p < 0.05$ family-wise error (FWE)) (Figure 1).

Conclusion

Our findings demonstrated that ID is associated with alterations in the visual network and the somatosensory network.

References

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3. Javaheipour N, Shahdipour N, Noori K, Zarei M, Camilleri JA, Laird AR, et al. Functional brain alterations in acute sleep deprivation: An activation likelihood estimation meta-analysis. Sleep medicine reviews. 2019;46:64-73.

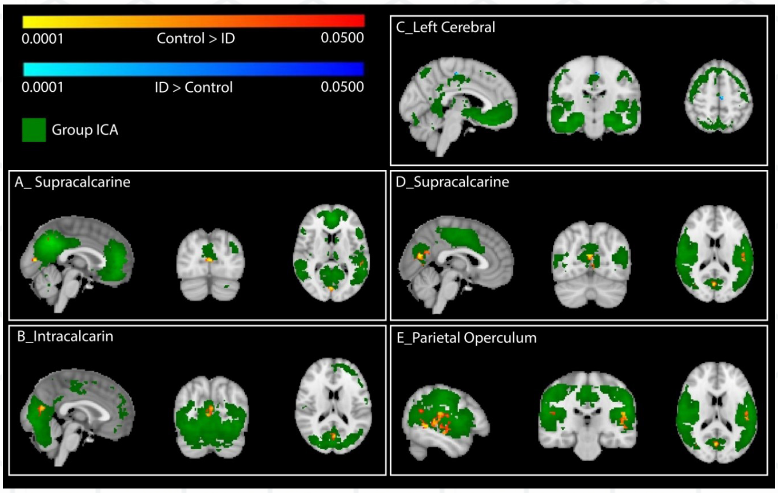

Figure 1.ICA results show functional connectivity differences between the control group and the patient groups with insomnia disorder ($p < 0.05$ FWE corrected)

Abstract No. 102

The Effect of Transcranial Alternating Current Stimulation on Changes in Blood Sodium Due to Anxiety in Patients Undergoing Surgery: A Double-Blind Controlled Clinical Trial

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Introduction

Pre-surgery anxiety is a natural response to stress (1). One of the most obvious symptoms is changes in water and electrolytes in the body, including a decrease in blood potassium. Numerous studies have shown the effect of anxiety on blood potassium levels, but there is not much information about the effect of anxiety on blood sodium levels. Today, electrical interventions as non-invasive methods have been widely used to control surgical anxiety and may have advantages in drug therapies. This study aimed to determine the effect of Transcranial Alternating Current Stimulation on sodium changes caused by preoperative anxiety in patients undergoing surgery.

Methods

This study was conducted on 50 patients undergoing surgery with anesthesia class. Before surgery, a Transcranial alternating current stimulation was done on the experimental group for 20 minutes. The control group underwent a sham electrical stimulation. The post-test was done 2 hours after the intervention and before surgery. The independent T-test, Chi-square and Kolmogorov-Smirnov tests were used to compare groups. The data were analyzed by SPSS v.16.

Results

Participants in this study were 32 males and 18 females. There were no differences in demographic variables between groups. There was no significant difference in the anxiety level of patients before the intervention. However, the anxiety level of the experimental group was less than the control group after the intervention (p=0/00). The level of anxiety in females (72/14± 98/2) was higher than males (78/12±77/1) before the intervention (p=0/006) but this rate didn't show any difference after the intervention (p= 0/075).

Conclusion

The results didn't show any significant correlation between two variables of anxiety level and serum sodium levels (P=0/479). The results of the present study indicated that Transcranial Alternating Current Stimulation is effective in reducing the pre-surgery anxiety of patients. in this study, no evidence of the effect of anxiety on serum sodium levels was observed.

References

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Abstract No. 103

Dynamical Assessment of Intrinsic Brain Networks in Insomnia Disorder

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Introduction
Insomnia disorder (ID) is accompanied by cognitive and emotional impairments, however, its neural underpinning is poorly understood [1]. Whole-brain neural dynamics (WBND) are coordinated for controlling efficient functions of the brain system and it has integrative roles in human cognition. So deflection of large-scale neural dynamics is an important field of study [2]. Here, we assessed WBND in terms of attractor dynamics in the energy landscape of fMRI resting-state networks including the salience network (SAN) and default mode network (DMN) in ID [3].

Methods
Participants were 52 healthy controls and 42 ID patients (aged 21-68 years; F/M ratio~=2; 1.5T MRI) recruited from the Sleep Disorders Research Center, in the Kermanshah University of Medical Sciences. The diagnosis was based on ICSD-3 and psychiatric interview. After standard pre-processing, we prepared a time series of average fMRI signals of seven functional brain networks, binarized them, and fitted a pairwise maximum entropy model (MEM), which represent brain activity patterns [4]. We calculated energy values of all the possible brain activity patterns and searched for dominant brain activity patterns that showed locally minimum energy (attractor) values (Fig 1)[2].

Results
The MEM with 0.0732 error fitted on data. We observed 10 and 11 attractors in the control and patient group respectively and 3 different attractors between them (Fig 2). For example, in #1 attractor 4 networks (sensorimotor network (SMN), visual network (VIS), SAN, dorsal attention network (DAN)) were in approximately similar energy state.

Conclusion
Energy landscape indicates the appearance probability of each brain activity pattern and lower energy activity patterns are more inclined and should be stable with higher appearance. Calculating energy state is a way to understand between-network connectivity [4] and when we see 4 networks in attractor, with more study, more brain activity patterns must be found, even if it's not demonstrated through other ways like connectivity.

References
[1]Tahmasian, M., et al., A lack of consistent brain alterations in insomnia disorder: an activation likelihood estimation meta-analysis. Sleep medicine reviews, 2018. 42: p. 111-118.
[2]Watanabe, T. and G. Rees, Brain network dynamics in high-functioning individuals with autism. Nature communications, 2017. 8(1): p. 1-14.
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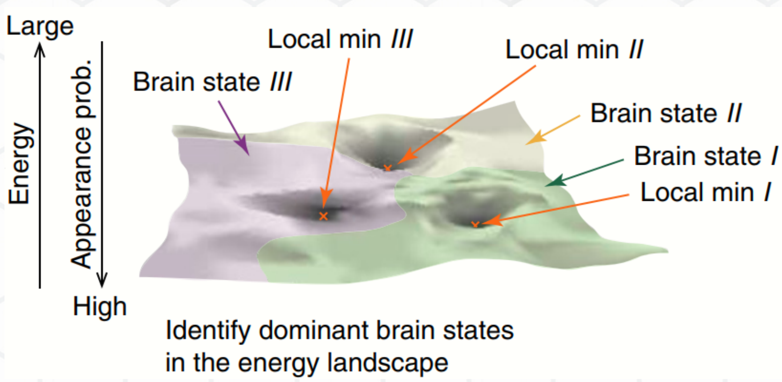

Figure 1: Energy landscape [3]. As an example, in our healthy control group we have 10 local minimums

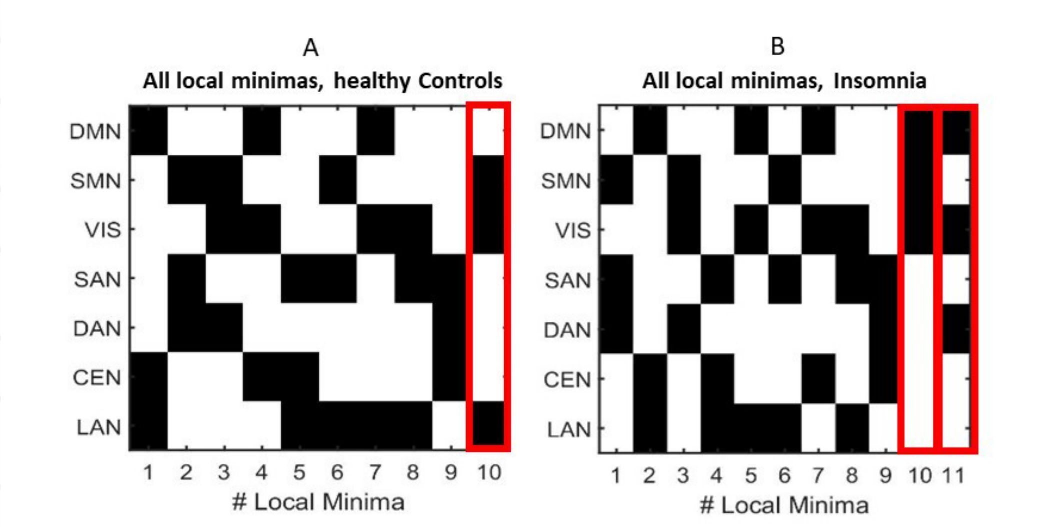

Figure 2: Local minima. We have 10 and 11 attractors in those two groups. Dark is inactive and white is active. 3 between group differences are marked as red. CEN – central executive network, LAN – language network.

Abstract No. 104

Investigation of the Differences of Anterior Cingulate Cortex (ACC) And Frontal Lobe Activity Between MDD And Control Group With EEG

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Introduction
About 300 million people around the world are suffering from depression. Also, one in five people around the world has experience Depression symptoms, at least one time in his life. Previous studies have shown increasing theta frequency activity at the frontal and Anterior Cingulate Cortex (ACC) areas.

Methods
In this study, 27 patients with a clinical diagnosis of MDD disorder (15 males, 12 females) with a mean age of 40.77 and std=15.14 were examined with EEG. For the control group, normal data of neuroguide software was used. All 19-channel EEG waves were recorded according to the international 10-20 system. The noise has been eliminated by the ICA method. Then, using eLoreta software, the activity of the deep areas is calculated. The activity of ACC at theta frequency and anterior regions (Fp1, Fp2, F7, F3, Fz, F4, F8) theta and Alpha frequencies in both MDD and normal groups were calculated and compared.

Results
The results showed that there was an increase in theta frequency in the ACC area between 11 subjects of the MDD group. It has also been shown that there is an increase in the frontal Theta and Alpha frequencies of respectively 14 and 14 subjects in the MDD group. The results also showed that there was a significant difference between the two subjects of the MDD group with the normal group in theta frequency of ACC and theta and Alpha frequencies of the frontal area.

Conclusion
Significant differences were found between the two groups of MDD and normal indicate the differences in the brain function of these groups. The difference in performance in the ACC region is also consistent with the results of the PET studies. Also, the difference in frontal theta and Alpha frequencies, which is consistent with previous results of EEG studies, can mean frontal lobe dysfunction in major depressive disorder and dysfunction in executive functions.

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Abstract No. 105

How Trust Priming Modulate Economic Decision Making in The Ultimatum Game: An ERP Study

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Introduction

This study investigated the effect of priming with trusty words on participant's behavioral responses to fair/unfair offers in a modified ultimatum game (UG). Besides, neural correlates of behavioral responses in three situations (no priming, trust/distrust priming) were compared. Two well-known ERP components in UG recipients were analyzed including; the feedback-related negativity (FRN) and the P300.

Methods

The EEG was recorded from eighteen subjects, during UG playing task, using a 32-channel Psychlab system. Before EEG recording, the participants were told that they would play as a recipient in the UG with a stranger in the other room as a proposer. Each participant played UG in three situations including; no priming, trust and distrust priming. The standard preprocessing pipeline was implied on the EEG data using EEGLAB 14.1.1 To remove artifacts. Then FRN and P300 components were extracted using the ERPLAB plugin. Subsequently, behavioral and neural responses at the three mentioned conditions were statistically compared using the repeated measure ANOVA and paired t-test as the post-hoc analysis.

Results

Behavioral data analysis, showed accepting rate was significantly affected by the type of offer and a higher acceptance rate was for fair as compared to unfair offers in all priming situations. These findings support the inequity aversion in human economical decision-making. The rate of acceptance in the non-priming situation decreased as compared to trust priming, because of the negative association the word trust may bring to the mind in the cultural setting of the study. The neural data analysis showed the FRN amplitude was more negative in distrust priming versus no priming at the frontal regions, and no significant difference was observed in fair versus unfair offers. No significant difference was observed for the P300 component.

Conclusion

Based on the FRN amplitude changes, we suppose distrust priming can more significantly influence the participant's fairness consideration.

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Abstract No. 106

Emotion Recognition via fMRI-Derived Brain States using Deep Neural Network

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Introduction

Emotion is one of the most important aspects of human life, and understanding them is challenging, especially for computers but the use of reliable measures such as blood oxygenation level-dependent (BOLD) signals measured by functional magnetic resonance imaging (fMRI) could help us better understand them.

Methods

We applied Long Short-Term Memory (LSTM) neural network [1] to fMRI-derived beta-series matrices of dimension 90×37130 corresponding to 90 stimuli and 37130 gray-matter voxels to predict the normative valence and arousal scores (in 9-point Likert scale) of affective stimuli [2]. We also used our model as a classifier to classify each stimulus responses into two categories: high/low arousal and positive/negative valence. The proposed deep learning neural network model consists of two fully connected LSTM layers, a dropout layer, and a dense layer. Owing to deep networks' overfitting nature, both elastic net and dropout regularization approaches were used to further enhance the network's generalization capabilities. The model was trained on 80% of each subject's data and tested on 20% of the remaining data based on 5-fold cross-validation scheme.

Results

Four different binary classifiers were trained on the mentioned feature matrices and the algorithms were applied to each subject separately. Then, the comparison between the average accuracy of all subjects provided by each model is reported in figure 1. After performing chi-square feature selection, the classification accuracies improved from 70% to 80% for valence, and from 73% to 81% for arousal. The proposed model was also trained as a regression model. Pearson's Correlation Coefficient results are also summarized in table 1.

Conclusion

Results indicate that deep learning, should there be enough data, is a promising choice for emotion recognition as features can be learned directly from raw data. As stated, LSTM achieves higher average accuracy over subjects compared to other traditional methods.

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Model	Valence			Arousal		
	Train CC	Test CC	Test MAE	Train CC	Test CC	Test MAE
LSTM	0.95	**0.61**	**0.120**	0.94	**0.60**	**0.094**
Non-linear SVM	0.98	0.58	0.132	0.98	0.57	0.096
Linear SVM	0.99	0.59	0.128	0.98	0.58	0.095

Table 1: The regression performance obtained from various models

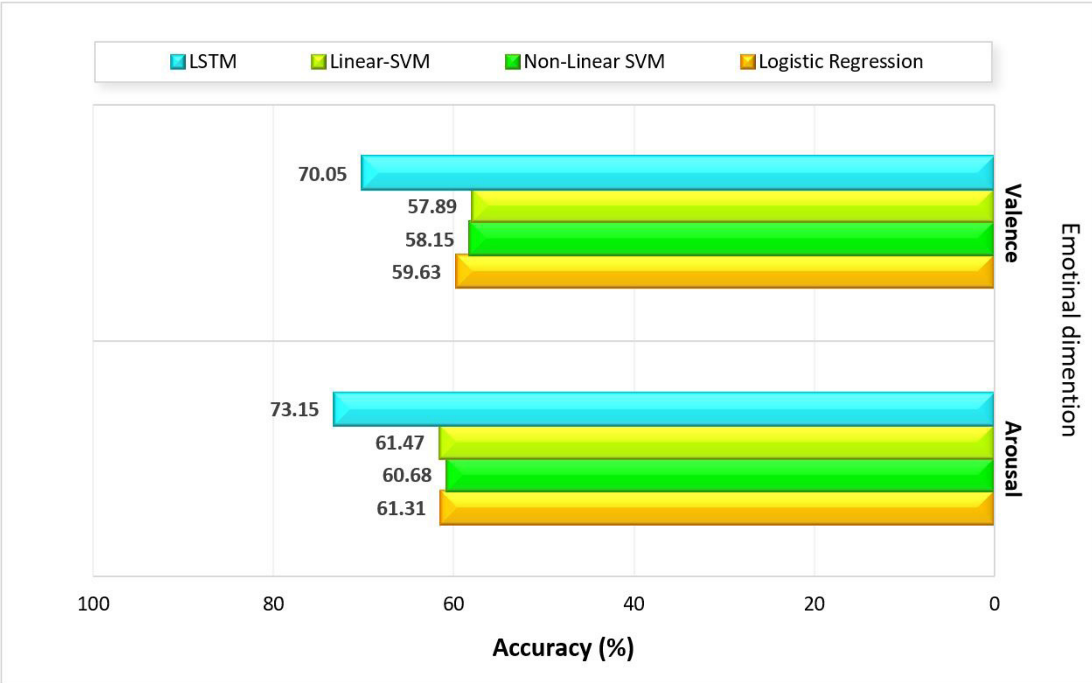

Figure 1: The classification performance obtained from various models.

Abstract No. 107

The Effect of Neurofeedback Training on Anxiety in Children with Attention-Deficit/ Hyperactivity Disorder

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Introduction
Anxiety is particularly important in hyperactive children and neurofeedback is being used as a relatively new therapeutic approach for the treatment of diseases and disorders. The purpose of this study was to investigate the effect of neurofeedback training on the anxiety of children with attention-deficit/hyperactivity disorder.

Methods
This study was a quasi-experimental study with a pre-test and post-test with a control group. The statistical population included all children with ADHD referred to Parsian Hospital Counseling Center in the year 1398. A total of 40 children were selected by convenience sampling and randomly assigned to two groups (each group of 20). The experimental group was trained in the neurofeedback method for 12 sessions of 60 minutes. The Cattell Anxiety Inventory was used for data collection. Data were analyzed by SPSS software version 19 using a multivariate analysis of covariance (MANCOVA).

Results
The results showed that the mean and standard deviation of anxiety in the neurofeedback group was 84/47 ± 4/24 before the intervention, but after the intervention, the mean and standard deviation of anxiety in the neurofeedback group changed to 18/36 ± 3.83. The results also showed that neurofeedback training significantly reduced anxiety in children with attention-deficit/hyperactivity disorder ($p<0.001$).

Conclusion
Evaluation of the effectiveness of treatment on anxiety in overactive children showed that neurofeedback decreased anxiety in the whole experimental group. According to the results of this study, it is recommended that therapists and clinical psychologists use neurofeedback training to reduce anxiety in children with attention-deficit/hyperactivity disorder.

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Abstract No. 108

Low Grade Glioma Segmentation: An Open Challenge

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Introduction

Glioma is the most common tumor among all brain tumors. Low-Grade Glioma (LGG) is one of the four grades based on the World Health Organization (WHO) criteria. Using MRI images, the accurate segmentation of LGGs is one of the most crucial treatment procedures. Meanwhile, automatic segmentation is still hard to be achieved because of the diversity of LGGs in size, shape, texture, and location. This study compares two methods of LGG segmentation working based on the thresholding and gradient vector flow techniques.

Methods

Two segmentation methods were applied to the ten subjects of The Cancer Imaging Archive (TCIA) data set [1]. The first one was based on using Otsu's Thresholding technique [2], morphological operations, and extraction of tumor features [3]. The second approach was parametric active contour (Snake) based on Gradient Vector Flow [4]. A snake is an energy minimizing, deformable spline influenced by constraint and image forces that pull it towards object contours and internal forces that resist deformation. For evaluating, all results were obtained from two methods compared with the ground truth mask, which was downloaded from the data set using the Dice and Jaccard similarity ratio.

Results

Both similarity ratios of the two methods were obtained close to each other. However, the snake method had better similarity scores than the method working on the thresholding technique. The mean similarity scores for both methods are given in Table 1. Furthermore, the results of segmentation for one of the subjects is shown in Figure 1.

Conclusion

We have examined both methods so far. Although the Snake method had a slightly better similarity score than the first approach and both methods had relatively good results, the results of both methods are still far from Grand Truth and should be closer to it. Our suggestion for future works is to use these methods in machine learning and deep neural networks.

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Method	Dice similarity score	Jaccard similarity score
Otsu's Threshold + morphological operations	0.880482406	0.878498218
Snake	0.881752956	0.914723686

Table 1: The mean similarity scores of two methods.

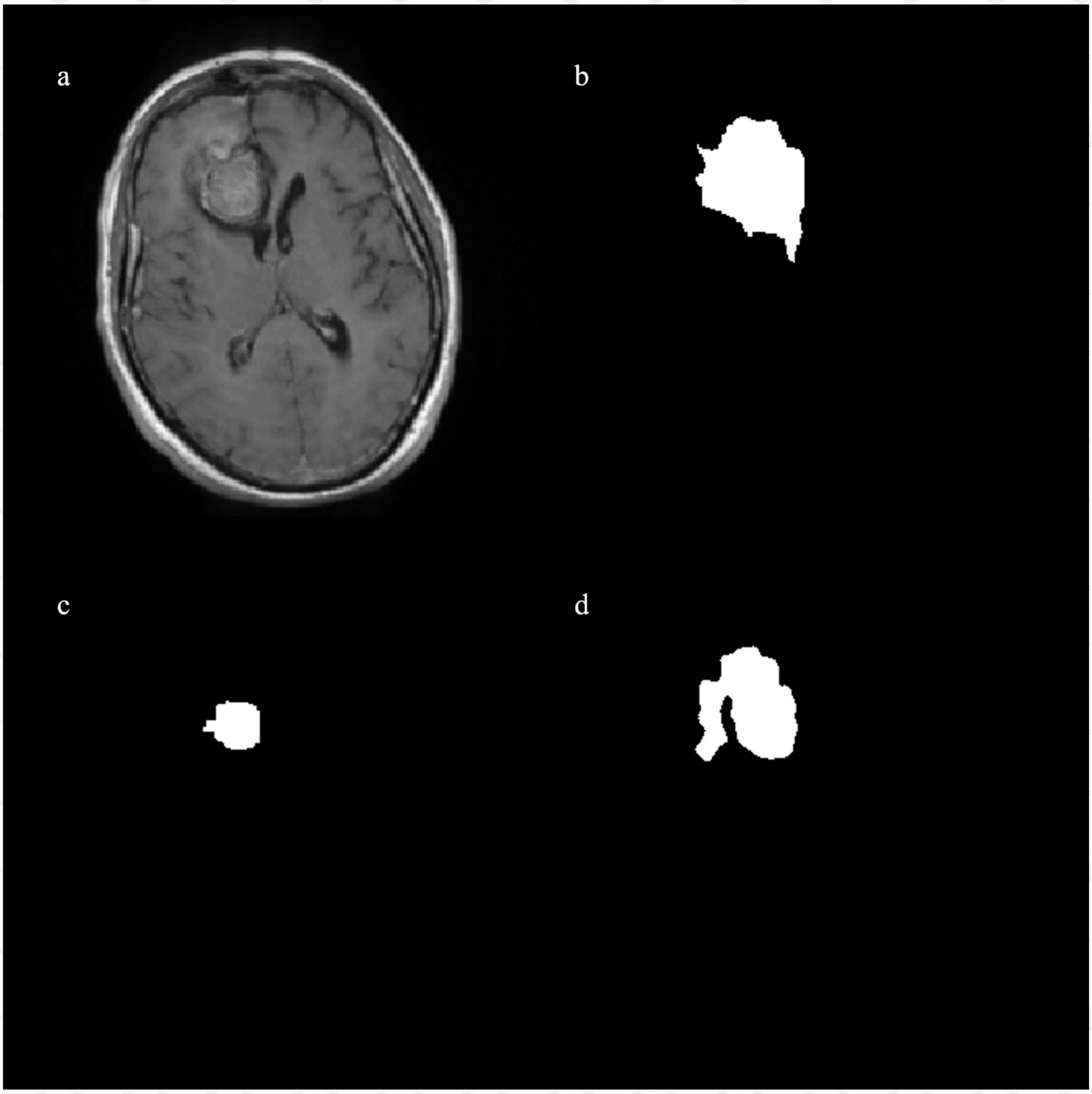

Figure 1: Result of segmentation for a sample subject:
a) raw image b) ground truth c) Otsu's Threshold+ morphological operations d) Snake.

Abstract No. 109

The Effect of Sleep Deprivation on the Association between Positive Affect and Resting-State Networks

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Introduction
Previous studies reported that individuals with sleep deprivation (SD) have a less positive affect (PA) than individuals with normal sleep [1]. We aimed to compare the association between PA and resting-state networks after a night of normal sleep and partial SD for a better understanding of the neural correlates of PA after SD.
Methods
We analyzed T1-weighted and R-fMRI images of 30 healthy subjects from the Stockholm Sleepy Brain study [2]. In a cross-over design, two sessions were recorded after partial SD (3h sleep) and normal sleep. The PA had been studied by PA subscale of positive and negative affect schedule [3] after normal sleep or SD. Preprocessing was performed using DPARSF toolbox. Group independent component (IC) analysis was applied using the GIFT toolbox for each group. We performed transformation into PA score-first singular value space for each IC and mapped subjects' IC features in this space. We measured the PA effect on resting-state integrity by linear regression in each condition. Finally, paired t-test analysis was performed by coding in MATLAB to find significantly different trends (p-value<0.05).
Results
Results showed that there were significant differences in the association between PA scores and integrity of the primary visual network, secondary visual network, default mode network (DMN), and left the fronto-parietal network (Table1 and Figure1). The higher PA scores, the lower the integrity in primary and secondary visual networks after normal sleep. The higher PA, the higher the integrity in primary and secondary visual networks after SD. After normal sleep, individuals with higher PA had higher integrity in DMN and left fronto-parietal networks. After SD, individuals with higher PA had lower integrity in DMN and left fronto-parietal networks.
Conclusion
Our result shows that dysfunction in transferring data in the mentioned networks is associated with low PA after SD and suggests such dysfunction serves as specific psychopathology of SD.
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Networks	Slope (95% confidence range) after normal sleep	Slope (95% confidence range) after sleep deprivation
Primary visual network	0.1361* (-0.8686, 1.141)	-0.8036* (-1.473, -0.1347)
Secondary visual network	0.2258* (-0.9716, 1.423)	-0.7495* (-1.599, 0.09966)
Default mode network	-1.148** (-2.352, 0.05538)	0.3389** (0.05631, 0.6214)
left fronto-parietal network	-0.01555* (-0.8093, 0.7782)	-0.01555* (-0.8093, 0.7782)

note: *p< 0.05; **p<0.01

Table 1: Regression coefficients of slopes of the relationship between positive affect scores and component effect after normal sleep and sleep deprivation

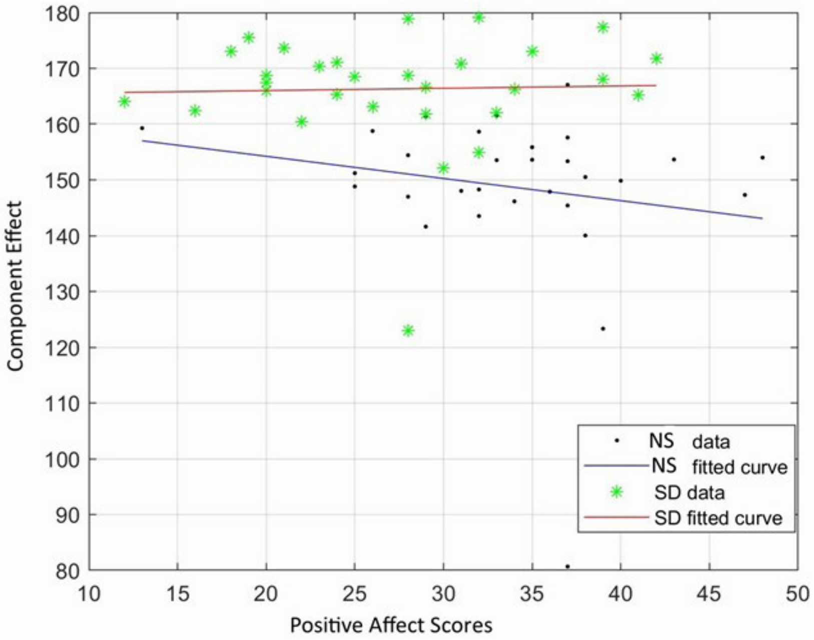

Figure 2: The associations between component effect within the DMN and positive affect scores after sleep deprivation and normal sleep. As the positive affect increases the component effect within DMN increases after sleep deprivation. However, as the positive affect increases the component effect within DMN decreases after normal sleep. Abbreviations: NS: normal sleep; SD: sleep deprivation.

Abstract No. 110

Sleep Quality Scores Predict Depressive Symptoms via Brain Structure: An HCP Study

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Introduction

Sleep disturbances are common symptoms in depression [1]. Functional connectivity links mediate the effect of sleep quality on depressive problems [2]. Moreover, the gray matter volume of the right insula mediates between depression/anxiety and sleep quality among college students [3]. Nevertheless, the predictive role of brain structures in the association of sleep quality and depressive symptoms is still unclear. We aimed to identify whether sleep quality can predict depressive symptoms, as well as to assess the role of brain structures in the association between sleep quality and depressive symptoms in healthy subjects.

Methods

In this study, we included 1101 participants from the human connectome project (HCP, 598 females, 22-35 years). Depressive symptoms and sleep quality were assessed using the portion of the depressive problem of the Achenbach adult self-report and Pittsburgh sleep quality questionnaires, respectively. The ensemble machine learning algorithm was used for the prediction of depression based on sleep quality scores. Then, we used structural equation modeling to find the gray matter structure's role in the relationship between sleep and depressive symptoms. We controlled for age and gender in all analyses.

Results

The results revealed a significant correlation between sleep and depressive symptoms ($r = 0.37$, $p < 0.001$). The ensemble machine learning algorithm predicted depressive symptoms based on sleep quality (Accuracy = 0.8, Mean Square Error (MSE) = 11.41, Mean Absolute Error (MAE) = 2.53, 95% Confidence Interval (CI) = 3.81_4.86, and R^2=0.46. (Figure 1). After Bonferroni correction, we found two brain regions (the right somatomotory area and cerebellum) that had a significant correlation with depressive symptoms ($p < 0.05$). Mediation analysis showed that these regions are partial mediators on the effect of sleep quality on depressive symptoms (Table 1).

Conclusion

Our findings demonstrated that sleep quality scores predicted depressive symptoms via the right somatomotory area and cerebellum in healthy subjects.

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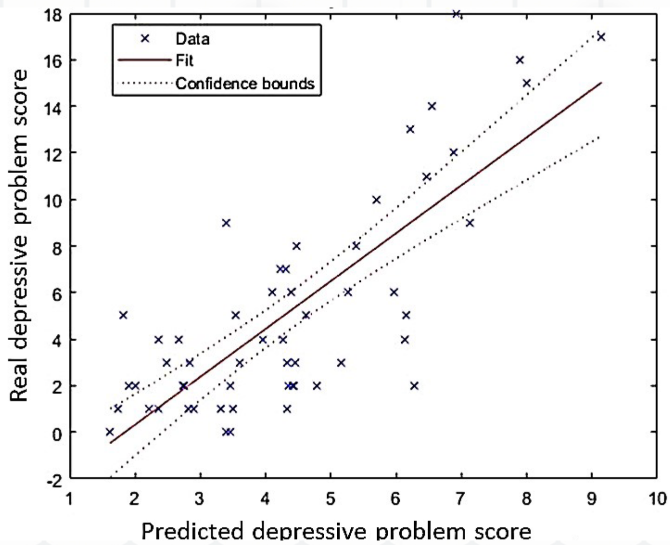
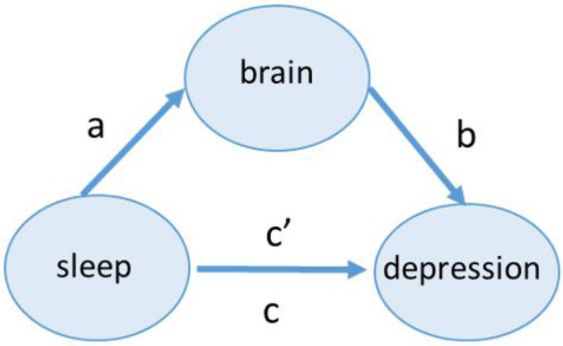


Figure 1: Prediction of depressive symptoms from sleep quality scores. Ensemble machine learning using features of sleep quality predicts the severity of depressive symptoms. Twenty features of sleep quality assessed by Pittsburgh sleep quality questionnaire. And depressive symptoms assessed by self-report depressive problem score of Achenbach questionnaire. Accuracy was assessed by the correlation between real and predicted depressive scores. (Accuracy = 0.8, Mean Square Error (MSE) = 11.41, Mean Absolute Error (MAE) = 2.53, 95% Confidence Interval (CI) = 3.81_4.86, and R^2=0.46)



Mediators of effect of sleep quality on depressive scores				
regions	**Path a**	**Path b**	**Path c’**	**Path c**
Right hemisphere_Somatomotor	β=-0.003***	β=-4.184**	β=0.445***	β=0.46**
Cerebellum	β=-0.003***	β=-3.549**	β=0.448**	β=0.46**

Table 1: Mediation analysis. Paths a, b, and c are statistically significant (bootstrapped). The mediation results suggest that the gray matter volumes of the right somatomotory area and cerebellum partially mediates the effect of sleep quality depressive symptoms. **p<0.05; ***p<0.001).

Abstract No. 111

Neural bases of Syntactic Priming in Action/Non-Action Related Second Language Production
(Preliminary Study)

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Introduction

Action and object-related sentences are processed through different brain networks. This diversity potentially results from syntactic roles on action and object (as verb and noun, respectively) [1][2][3]. To study the effect of such diverging types, we evaluated action and object-related sentence productions. We additionally studied the effect of syntactic priming on object/action sentence production. We aimed at investigating whether these two sentence types(ST) are primed differentially using behavioral and electrical neuroimaging using EEG.

Methods

For this aim, we recorded EEG of 14English language-learners (Right-handed, Upper/Intermediate) while doing a picture description task. The task included 4conditions: Object and Action picture description with and without syntactic priming. Subjects were instructed to produce a single sentence to describe the presented picture. The EEG was recorded continuously using 64-channel EEG. Data on response accuracy and response time were analyzed using a 2*2 repeated measures ANOVA using ST(Action vs Object) * Prime (Primed vs Non-Primed). Topographic and global filed power analyses of event-related potentials were performed using the same design to compare neural activity in response to different task conditions.

Results

Our behavioral results confirmed main effect of priming in both response accuracy ($F(1,13)=6.01$, $p=0.03$) and response times($F(1,13)=13.6$, $p=0.003$) (better performance in primed conditions). Neither the main effect of ST nor interaction between ST and Prime was seen (Figures 1).

Our EEG topographic analyses revealed a significant main effect of ST at around 300ms post-stimulus onset. There was also a main effect of Prime during the whole post-stimulus onset-time period. These results represent different brain areas involved in processing Action vs Object description in a time window related to stimulus evaluation and categorization (the same time window as P300).

Conclusion

Our preliminary results suggest that one possible source of difference between action/object description at EEG level is related to processing steps related to stimulus categorization and decision making.

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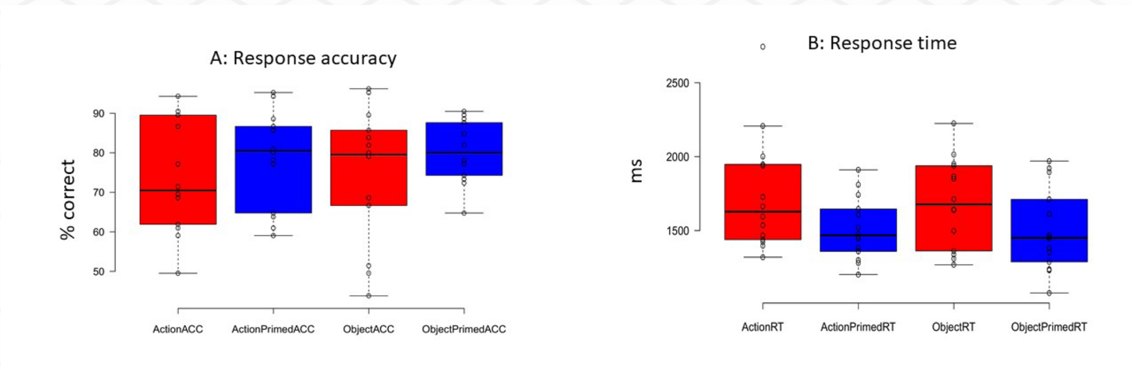

Figure 1: Sentence type (Action vs Object) * Prime (Primed vs NonPrimed) Response accuracy

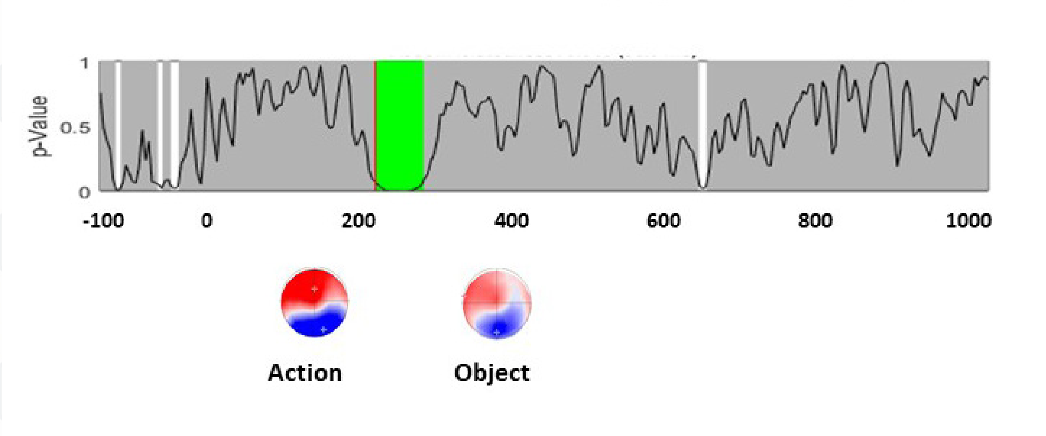

Figure 2: Main effect of sentence type (Action vs Object)

Abstract No. 112

Automated Parcellation of Human Cerebral Cortex Using Gross Morphological Characteristics

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Introduction
Brodmann [1] identified 55 areas on the human cortex using cytoarchitecture patterns and morphological differences between cortical regions. However, no quantitative method was used. Moreover, several studies have used functional and structural imaging techniques that suggest more cortical areas. In this study, the human factor was removed and mathematical measurements were applied on the BigBrain dataset to parcellate the human cerebral cortex.

Methods
Firstly, the pial layer and the gray matter / white matter boundary of the 8bit 200μm BigBrain were identified using Freesurfer software to measure five features: thickness, surface area, volume, curvature, and coordination for every vertex. Secondly, all the vertexes were distributed to 36 blocks based on the Desikan-Killiany atlas. Finally, a density-based scan (DB-scan) clustering algorithm [2] was applied on features and the input parameters were obtained using mathematical measurements applied to the data.

Results
After processing the data, 156 and 159 areas for the left and the right hemisphere were identified, respectively (Figure 1) with an RGB color for each one. The coordination feature was multiplied to 10 to enhance the integration of the areas, and thickness was multiplied to 40 for more significant results. To mention some important results, as illustrated in figure 2, the supplementary motor area (SMA) was identified on the first sections on the left hemisphere (2B), but in deeper sections in the right hemisphere (2C, 2E). Pre-SMA was identified in deep sections on both hemispheres (2B, 2E). Finally, the primary motor cortex and premotor cortex were parcellated into smaller areas (2A, 2C, 2D).

Conclusion
Qualitative comparison between our parcellation method and that of several others (such as [3]) showed striking similarity which suggests that 1) non-histological parcellation methods could be validated against our method 2) our method may be useful for cortical parcellation of individual cases.

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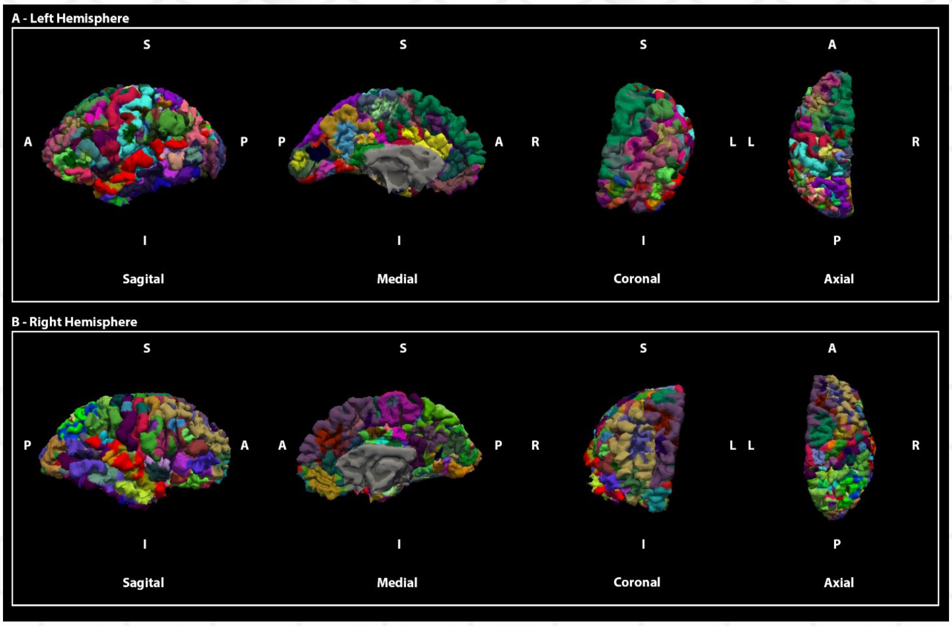

Figure1: Cortical areas identified on BigBrain by applying DB-scan algorithm on extracted features

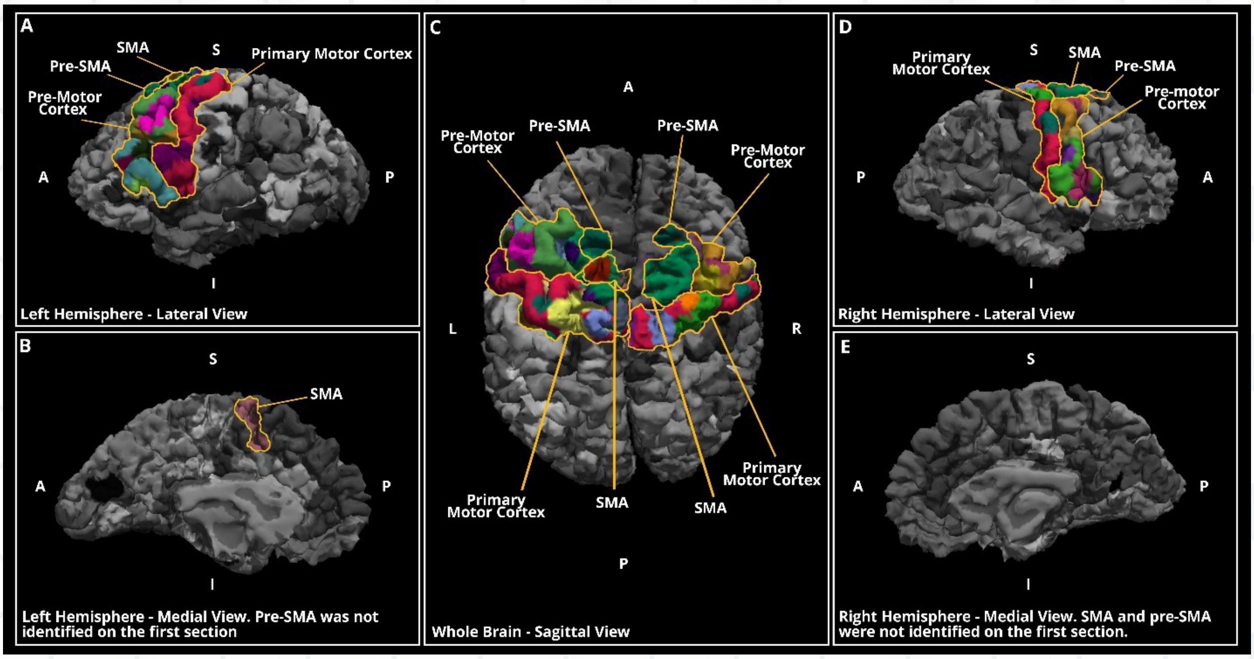

Figure 2: SMA, pre-SMA, primary motor cortex, and pre-motor cortex identified on the BigBrain

Abstract No. 113

Investigation of Functional Changes of Brain Topology in Insomnia Disorder

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Introduction

Sleep is a complex maintaining homeostasis process; lack of sleep disrupts whole-body functioning(1). Studies have shown brain networks have many special topological properties. Graph theory analysis can be adopted to investigate the functional changes at global and nodal levels. In graph theory, the brain network is defined as a set of nodes (denoting anatomical regions) and interconnecting edges (denoting functional or structural connections)(2). This study investigates the functional changes of brain topology in insomnia disorder (ID) and compares the global and local characteristics with a healthy group.

Methods

The rsfMRI and graph theory analysis method was applied to investigate the brain functional connectome patterns among 56 patients and 52 control subjects (20-60 years old). Participants were scanned with a 1.5tesla Magnetom-Avanto-Siemens scanner with an 8-channel head coil. We used CONN toolbox(3) with Harvard-Oxford atlas, The topologic properties of brain functional connectomes were tested. Global efficiency(GE) and local efficiency(LE) are the measures of network efficiency in transmitting information at the local and global levels (1, 2).

Results

The brain regions with statistically-significant for Control>Patient one-sided (Negative) in the ID patients, showed decreased GE in the left postcentral gyrus and increased GE in vermis ($p<.05$, p-FDR corrected) (Table 1, Figure1). We also saw statistically significant differences in LE.

Conclusion

The present study investigated topological brain functional connectome in ID. These patients showed altered GE in brain regions mainly implicated in the vermis and postcentral gyrus; vermis is intimately associated with all regions of the cerebellar cortex, having distinct connections with the brain. These regions are the vestibulocerebellum, which is responsible primarily for eye movements controlling and the postcentral gyrus is the primary somatosensory cortex and receives the majority of the somatic sensory relay information from the thalamus. Damage to the postcentral gyrus may result in contralateral somatosensory disturbances, primarily in tactile localization and discrimination and postural sensitivity(4).

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ROI by networks	Beta	T	Dof	p_unc	p_FDR
Vermis	-0.06	-3.59	106	0.000496	0.032734
Postcentral gyrus left	0.03	3.70	106	0.000396	0.032734

Table 1: Significantly altered global efficiency in ID patients compared with HCs.
P value ($p<.05$, uncorrected); For between subject contrast Control>Patient (one-sided(negative))

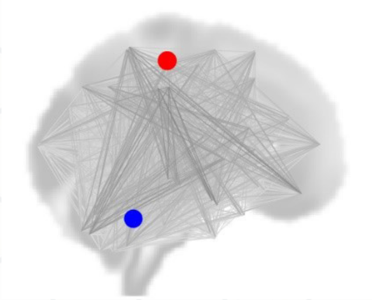

Figure1: Significantly altered global efficiency of the brain functional connectome in ID patients, compared with HCs ($p < .01$, uncorrected) for control>patient(one-sided-negative). Red node represents increased GE in the left postcentral gyrus. Blue node represents decreased GE in vermis.

Abstract No. 114

Brain Mediators of The Vicarious Facilitation of Pain

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Introduction

The response to noxious stimuli can be facilitated by observing another person in pain [1]. This effect has been suggested to result from a sensorimotor resonance through the mirror neurons, or an increased level of arousal [2,3]. In this study, we used the mediation effect parametric mapping (MEPM) to understand which regions of the brain mediate this effect.

Methods

We scanned 21 pain-free volunteers (10 females; mean age = 25.2±4.1) using fMRI while performing a vicarious pain facilitation paradigm. In each trial (N=24) participants observed neutral, fearful, or painful facial expressions, before receiving a shock that elicited the nociceptive flexion reflex (NFR), an objective indicative of nociceptive processing in the spinal cord and, recorded their subjective pain ratings. We used multi-level MEPM to test the mediation effect of trial-by-trial voxel-wise brain activity in response to shocks for the relationship between the emotional valence of the observed facial expressions and pain ratings or NFR responses, after FDR correction ($p<0.05$, $k=10$).

Results

The inferior frontal gyrus, inferior parietal lobe, ventromedial prefrontal cortex, paracentral lobule, cerebellum, and anterior cingulate cortex were significant mediators of vicarious facilitation of pain after observing both fearful and painful facial expressions. With the painful facial expressions, more widespread regions of the brain mediated this effect, additionally including the precentral gyrus, superior frontal gyrus, superior temporal gyrus, the temporoparietal junction, superior parietal lobule, insula, and thalamus. The increase in NFR after observing painful facial expressions was mediated by the putamen and superior temporal gyrus.

Conclusion

The vicarious facilitation of pain is mediated by regions that are part of the human motor neuron system or are involved in affective theory of mind, in addition to the regions involved in the emotional modulation of pain.

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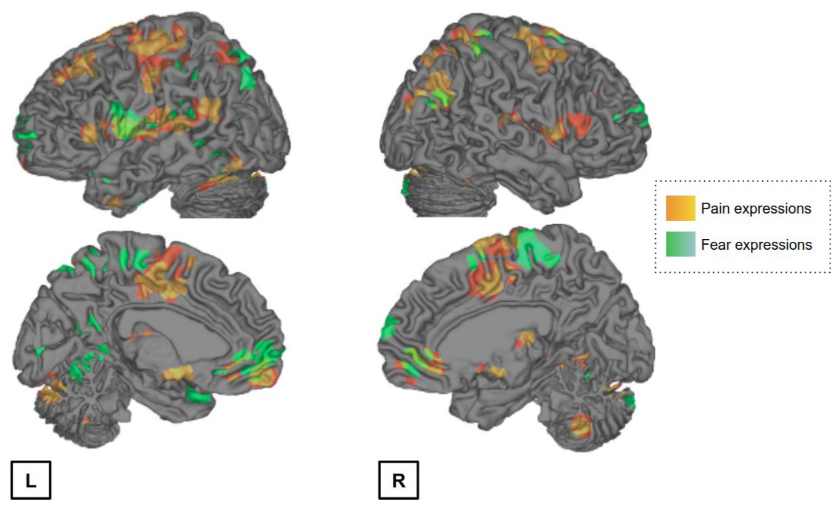

Figure 1: Vicarious facilitation of pain brain mediators. The clusters with a significant mediation effect for increased pain ratings in response to painful (orange) or fearful (green) facial expressions are shown. Lighter colors represent lower p-values.

Abstract No. 115

Assessing the Requirement to Change the Resting-state Networks throughout Lifespan Stages

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Introduction
Neuroplasticity is the capability of the neural system to modify its function when it encounters new situations and needs changes. Despite devoting many efforts to study neuroplasticity, measuring the requirement to change is not yet well described. In this study, we addressed this issue in the brain functional network over the lifespan using structural balance theory.

Methods
We selected 527 healthy male subjects from two publicly available repositories, ABIDE and Southwest. We preprocessed resting-states functional images of selected subjects and took out activity patterns of regions of interest. Afterward, we estimated the functional connectivities and binarized values of connections to get a signed network for each subject. Then, we counted triadic frustrations that appeared in the signed networks. We divided subjects according to Erikson's developmental stages including childhood, adolescence, early adulthood, middle adulthood, and late adulthood. Finally, we performed a multiple-group statistical analysis to compare the number of appeared frustrations between the stages of life. In addition to the number of frustrated triads, we also compared the percentage of negative links and topological measures of the Tendency to Make negative Hub (negative TMH) and negative degree distributions across the lifespan.

Results
We showed that the number of triadic frustrations of resting-state networks alters over the lifespan in a U-shape type manner with the lowest level in early adulthood. Interestingly, the percentage of the negative links behave in the same way and indicate a non-linear relationship with the number of frustrations. Although, we did not find any significant differences between different stages of the lifespan in terms of negative TMH and negative degree distribution.

Conclusion
According to the results, we concluded that the growing percentage of the negative links increases the number of frustrations as a measure of the requirement to change functional network; where negative TMH and negative degree distribution remain consistent.

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Abstract No. 116

Stepwise Brain Network Analysis During Alzheimer's Disease

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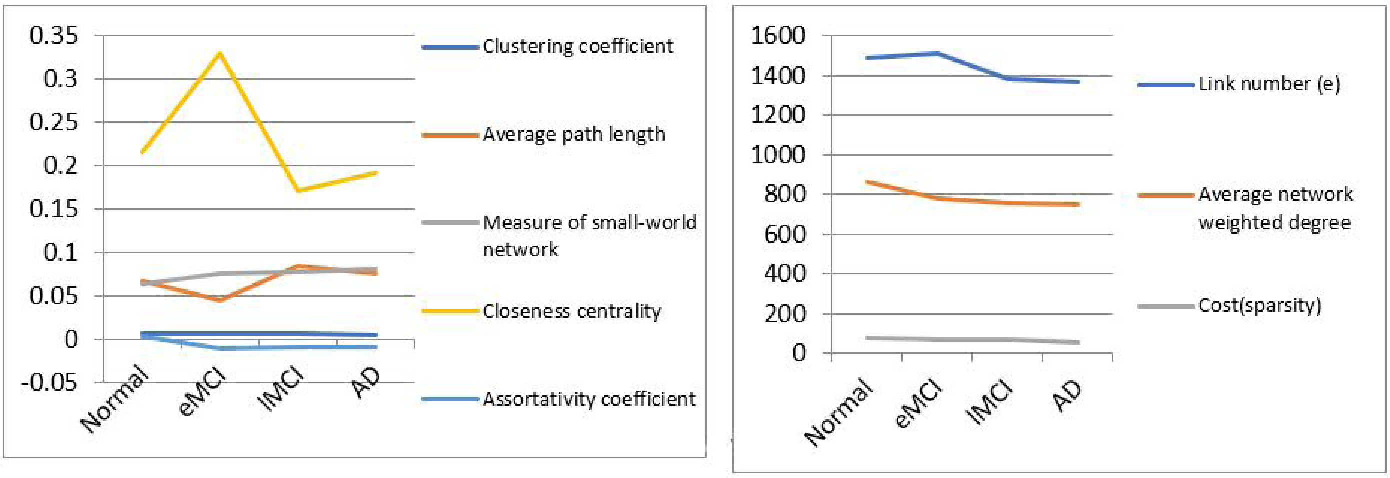
Introduction
Graph theory provides popular tools for studying complex brain networks. Alzheimer's disease (AD) is the most common form of wits, which as an incurable, progressive and neurological disease, reduces cognition and memory. Several papers are investigating the topological properties of the brain network for Alzheimer's disease. But, to the best of our knowledge, no one covers the topological changes of Alzheimer's disease during its different stages. In this research, we examine the weighted graphs of 202 participants who were pioneers in Alzheimer's disease brain imaging (ADNI), including 50 normal, 72 individuals with early mild cognitive impairment (eMCI), and 38 individuals with late mild cognitive impairment (lMCI) and 42 Alzheimer's (AD) patients.
Methods
The data in this paper are obtained from reference [1], which is a 70 × 70 weighted adjacency matrix for 4 brain networks in the Normal, eMCI, lMCI, and AD stages. In this study, several important graph topological parameters [2] for each of the networks of the four stages of the disease are calculated using the MATLAB toolbox (www.brainconnectivity-toolbox.net).
Results
Graphical views of numbers of topological changes have shown in figure 1. Topological feature changes of the brain network during Alzheimer's briefly include: the link number, average network weighted degrees, cost, clustering coefficient, average path length, a measure of small_world network, closeness centrality and assortativity coefficient. Interpretation of changes in any of the above parameters can provide a better understanding of Alzheimer's disease as it progresses.



Conclusion
It is useful to study the topological changes of the brain network to describe its connections. But this study is better to be during the whole period of the disease so that we can gain a better understanding of the pattern of changes in the structure of the physical communications of the brain over time.
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Abstract No. 117

How Can Deep Learning Track Brain Metastasis Using Convolutional Neural Network?

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Introduction

The mechanism of tumor generation and its function remains unknown. Also, metastasis, which is the spread of tumors in the body, is one of the researchers' concerns. The diagnosis of these abnormalities with different shapes and sizes is critical to the decision-making process; Especially when the metastasis occurs in the brain. Therefore, designing and utilizing an automated detection method and tracking can be helpful for clinicians. One of these methods named the Convolutional Neural Network (CovNet/CNN), is a deep learning algorithm that can take in an input image, assign importance (learning rates and biases) to various objects/aspects differentiate one from the other. In general, these kinds of networks are mainly composed of three different sub-networks including convolutional layers which have various types of filters that each filter recognizes a specific image texture/shape pattern. Pooling layers, which are responsible for dimension reduction to reach less computational complexity, and fully-connected layers which is the classification task. Therefore, in this study, we propose a deep learning method for tracking using a convolutional neural network (CNN).

Methods

This study used three-dimensional T1-weighted MPRAGE MRI data of 74 subjects with brain metastasis from breast, lung, prostate, and melanoma. We scanned these subjects in the Imaging Center of Imam Hossein Hospital. Aiming to track metastasis as an object in each slice, we used a ten folded CNN classifier with 56 data for the train and 18 data for tests after quality assurance and preprocessing. We compare our design with two popular methods Siam-FC and RT-MDNets.

Results

After the implementations, the algorithm made a prediction and tracing model for the brain metastasis. The three well-known evaluation quantities in tracking concepts are "Success", "Precision", and "Frame Per Second" (FPS). The results are presented in Table 1. Besides, frame by frame detection for a subject with one metastasis is shown in Figure 1.

Conclusion

We designed a model based on CNN that could track metastasis. This model can help radiologists diagnose tumors and reduce human error as much as possible. Although this algorithm still has shortcomings in detecting the initial slice, it works well in tracing and following the subject. Further studies with large sample sizes are warranted to an improved simulation of the system under study by the trained CNN.

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Method	Success	Precision	FPS
Ours	65	89	22
RT-MDNets	65	88	45
SiamFC	58.2	77	86

Table 1: evaluation measurements

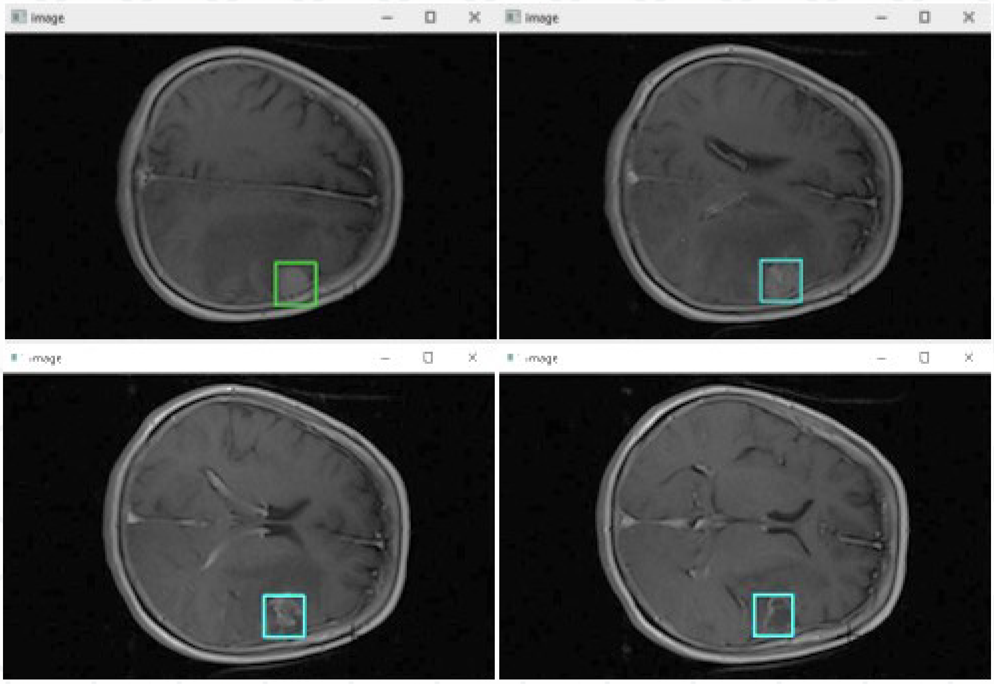

Figure 1: the result of metastasis tracking in four frames (a to d) from superior axial slice to Inferior one. movie link: (https://drive.google.com/file/d/1Nx-9uTw9yh5DeGHiUaf6PI7hI53DzRqv/view)

Abstract No. 118

Individual Alpha Peak Frequency as A Marker for Early Detection of Alzheimer's

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Introduction
Alzheimer's is a progressive neurodegenerative disease in which the patient loses his cognitive functions over a period of time. Most of all, it is a memory disorder. Early diagnosis of Alzheimer's disease can be an effective step in initiating treatment and preventing the progression of the disease. EEG is one of the most commonly used clinical neuroimaging methods to evaluate brain function. An individual's alpha peak frequency (iAPF) can be used as a neuromarker to evaluate overall brain performance speed and brain cognitive levels. By decreasing cognitive functions with age, it is expected that the level of iAPF is also reduced. The purpose of this study was to investigate the relationship between the iAPF index and the level of cognitive functions to predict the onset of Alzheimer's disease.

Methods
In this study, we investigate the relationship between iAPF index and MMSE (Mini–mental state examination) questionnaire in individuals over the age of 50 years. The MMSE is a test to assess the quality of consciousness by diagnosing and screening for dementia. The study involved 20 people over the age of 50 (5 men and 15 women) who referred to the office because of memory disorders. MMSE test was performed on these subjects and EEG was recorded for 10 minutes in eye closed condition based on 10-20 system. The iAPF index is obtained from the posterior regions of the brain. The relationship between the MMSE test score and the iAPF index is examined.

Results
Statistical analysis of the results showed a relationship between decreasing in iAPF index and cognitive problems (figure 1).

Conclusion
This study suggests that the iAPF index can be used as a warning marker to evaluate Alzheimer's diseases clinical symptoms.

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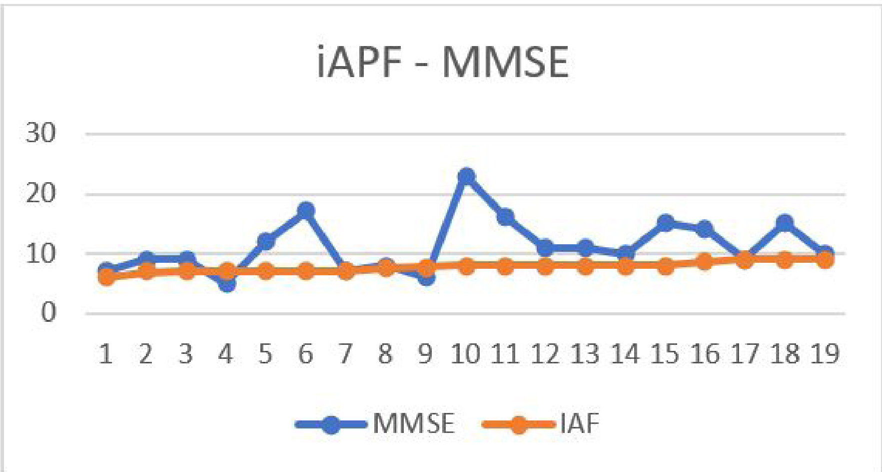

Figure 1: Relationship between decreasing in iAPF index and cognitive problems

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