سمپوزیم مشترک در علوم شناختی

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ICSS
مؤسسه آموزش عالی علوم شناختی

school of Cognitive Sciences

SATiM
School of Advanced Technologies in Medicine
Tehran University of Medical Sciences

چکیده سخنرانی ها

Achievements of ICSS Alzheimer's Disease Diagnosis Research Group (Dr. Morteza Amini)

The Alzheimer's Disease Diagnosis Research Group (ADDRG) has been active in ICSS since ۲۰۱۶. During this period, studies were conducted on methods for modeling disease progression and conducting an early diagnosis. During the past ۶ years, various theoretical and practical methods were evaluated including theoretical methods such as biosensor stimulation for early diagnosis as well as measuring disease progression via EEG, fMRI, and PET.

So far, the achievements of this research group include ۸ ISI articles, ۵ conference articles, and ۴ presentations. The most notable achievements of this committee are winning the best Iranian Ph.D. Research annual awards in ۲۰۱۹ and receiving the best article award from the ۹th Iranian Joint Congress on Fuzzy and Intelligent Systems (CFIS۲۰۲۲).

تغییرات مغزی در بیماران اسکیزوفرنی از دیدگاه شبکه ای (دکتر فرزانه کیوانفرد)

اسکیزوفرنی یکی از اختلال‌های شایع روانشناختی است که به عنوان سندروم قطع اتصالات مغزی شناخته می‌شود. مطالعات بسیاری به طرق گوناگون مناطق مغزی آسیب دیده و اتصالات درگیر این بیماری را شناسایی کرده‌اند. در این نوع از تحقیقات نیاز به فرضیه اولیه وجود دارد و نتایج نیز بسیار وابسته به الگوریتم‌های مورد استفاده است. برای رفع این محدودیت یک چهارچوب سیستماتیک ارائه شده است که بتواند بدون نیاز به فرضیه و به صورت کاملا کور تغییرات میان داده‌های آزمایش را بدست آورد. ورودی این روش اتصالات کل مغز در افراد مختلف است و خروجی آن تفاوت‌های میان داده‌های ورودی خواهد بود که به صورت زیرشبکه‌های از مغز معرفی می‌شود. این زیرشبکه‌ها می‌تواند به تفاوت‌های شناختی بین افراد مختلف گروه افراد سالم اشاره کند و یا تغییرات مغزی در اثر بیماری را معین نماید.

Addictive disorders, prevention and treatment with new approaches (Dr. Nader charkhgard)

Addiction includes a wide range of disorders, Research on different types of addiction has shown that addiction is not a homogeneous phenomenon and this has implications for loss of control. The probability of initial use and the probability of progression toward a pathologic pattern of use are influenced by intrinsic factors (eg, genotype, sex, age, age at first use, preexisting addictive disorder, or other mental illness), extrinsic factors (eg, drug availability, peer influences social support, childhood adversity, parenting style, socioeconomic status), and the nature of the addictive agent (eg, psychoactive properties, pharmacokinetics, mode of use or administration). New approaches to prevention and treatment require the identification of objective factors, similar to the identification of disease-causing factors in other branches of medicine.

Here, I will mention about the research that has been done in this field to know the biological and neurobiological factors affecting addiction (such as the effect of testosterone and oxytocin) in the Department of Neuroscience and Addiction Studies in the school of advanced Medical Technologies of Tehran University of Medical Sciences and regarding the impact of these studies on new approaches to prevention, treatment and policy, I will also evaluate the discussion and the future of addictive disorders.

Learning how others' beliefs change in light of hierarchical Bayesian reasoning (AmirHossein Tehranisafa)

Hierarchical Gaussian Filter (HGF) is a recent derivation based on Bayesian principles that support a hierarchical generative model of the environment and its (in)stabilities. The HGF is a principled and generic approach to dealing with uncertainty in perception. Besides being computationally efficient, it allows for online estimation of hidden states, and it has found numerous applications to experimental data from human subjects.

Using hierarchical generative models, we developed a model that allows a gambler to make a choice between gambling and getting a safe payout. Having inverted the model, we were able to optimize the posterior density probabilities over unknown states (risk attitude and its volatility over time). This ٣-level Hierarchical Gaussian Filter consists of a set of clear, trial-by-trial instructions to update the sufficient statistics of the posterior expectation about the decision maker's risk attitude and its volatility over time and its update rules can be summarized in terms of RL models as a whole.

In the three-level HGF, the learning rate is adjusted in proportion to the degree of uncertainty. On the other hand, the non-hierarchical Bayesian learner can only learn about unchanging risk attitudes and RL-based strategies are useful when the changes are predictable (tonic volatility), but cannot be used when risk attitudes change suddenly (phasic volatility).

مطالعه کارکردی تصویربرداری عصبی اثرات روان درمانی دلبستگی به خود: بارویکرد مدل‌سازی علّی پویا (<mark>هاجر امین زاده</mark>)

یکی از اختلالات شایع روان پزشکی اختلال افسردگی است. افسردگی اساسی نوعی از افسردگی است که با اختلال عاطفی و اختلالات شناختی در رفتار مشخص میشود. از طرفی با ظهور علوم اعصاب محاسباتی و مطالعات تصویربرداری عصبی می توان نشان داد که این نقایص شناختی ممکن است با تغییر شکل اتصالات در شبکه مغزی و یا نوع مدوله شدن ناسالم احساسات در مدارهای مغزی مرتبط باشد.

اگر افسردگی را در سطوح مدارهای مغز مطالعه نماییم، به طور کلی چهار شبکه عصبی اصلی موثر در افسردگی اساسی می توان در نظر گرفت که یکی از این شبکه ها شبکه پاداش و دیگری شبکه پردازش احساسات می‌ باشد. از آنجایی که بسیاری از اختلالات افسردگی ریشه در کودکی و دلبستگی های نا ایمن فرد دارد در این پژوهش از یک روان درمانی به نام "دلبستگی به خود" استفاده شده است. در واقع، درمان دلبستگی به خود (SAT) یک شیوه خود درمانی الگوریتمی است که فرد پس از یادگیری پروتکل های درمان و اجرای مکرر آنها می تواند از روان درمانگر مستقل شده و خود می‌تواند شبکه عصبی بهینه‌ای ایجاد نماید که جایگزین مدارهای عصبی غیر بهینه شوند. این درمان بر پاسخ به این سوال متمرکز است که چگونه می‌توان انسان‌هایی را که از کودکی خود پایه‌های بنیادی دلبستگی ناکارآمدی دارند و این امر سبب اختلال افسردگی در بزرگسالی شده است، با پایه‌های کارآمد مجهز کرد؟ تمرکز اصلی این پژوهش بر ارایه یک مدل با رویکرد بیزی (رویکردی احتمالی که این امکان را فراهم می کند که اطلاعات جدید با اطلاعات موجود ترکیب شود) می باشد. بدین منظور استفاده از رویکرد مدل‌سازی عِلّی دینامیکی که بر پایه مغز بیزی استفاده شده است. تا بتوان ساختار شکل‌گیری احساسات و شکل‌گیری باورهای جدید در روند درمان دلبستگی به خود را بررسی نماییم.از طرفی با بررسی روند درمان توسط داده‌های تصویر برداری مغزی و سپس تحلیل دینامیکی آنها، می توان پروتکل‌های درمانی را ارتقاء بخشید و مهمتر آنکه با شکل‌گیری احساسات و باورهای جدید توسط پروتکل‌های درمانی این فرضیه شکل می‌گیرد که نتایج این درمان بر روی بعضی بیماران افسرده بهینه و پایدارتر از بسیاری از درمان‌های دارویی و یا روانپزشکی باشد.

این پژوهش بر روی ۲۰ نفر از افراد مبتلا به افسردگی اساسی اجرا شده است و روند درمان توسط تصویربرداری fMRI بررسی شده است. سپس داده های fMRI با رویکرد مدل سازی علی مدل سازی شده و از نتایج مدل برای بررسی روند تغییر اتصالات موثر شبکه در روند درمان استفاد شده است. نتایج نشان می دهند که ساختار مدل در قبل از درمان و بعد از درمان بیانگر تفاوت های بسیار قابل توجهی در معماری های عصبی برای پردازش احساسی در دو مرحله است. احساسات happy و sad به طور متفاوتی در مرحله قبل و بعد از درمان مدوله شده اند و اتصالات بالا پایین (کورتکس به آمیگدال) در طول درمان تقویت شده اند.

High-level visual processing in Alzheimer's Disease (<mark>Haniyeh Marefat</mark>)
Backgrounds It is well-established that non-memory systems i.e., sensory systems including visual, auditory and olfactory are disrupted in early stages of Alzheimer's disease (AD) (Albers, Gilmore et al. ۲۰۱۵). Within high-level visual areas, ventral visual stream impairment responsible for object recognition is more pronounced than dorsal visual stream responsible for spatial localization. In addition to high-level visual processing, speed of processing is also affected in AD. It has been known that disruption in daily tasks performed with the help of vision is not only due to impaired visual system but also due to slowing down of information processing speed (Sekuler and Ball ۱۹۸۶). It has been observed that the speed of performing various cognitive tasks is slowed down in the elderly and older people have difficulty performing tasks that are particularly

timesensitive. Designing a task that involves the high-level ventral visual system and at the same time requires a high speed of information processing can identify brain defects in the early stages of Alzheimer's disease. We designed an ultra-rapid animacy categorization task to study brain impairments in early stages of AD. **Methods** 20 healthy controls (HC), 15 subjects with mild cognitive impairment (MCI) and 10 patients with mild Alzheimer's disease were recruited. All subjects were age, gender and education matched. Participants were instructed to do an ultra-rapid visual animacy categorization task called Integrated Cognitive assessment (ICA) (KhalighRazavi, Habibi et al. 2019) while were in the MRI scanner. Participants were expected to categorize if the presented image contained a picture of an animal or not by pressing right and left buttons, respectively and were told to respond as fast and accurate as they could. Data was analyzed with univariate approach to explore level of activity and with multivariate-pattern analysis (MVPA) to investigate pattern of activity. In MVPA, we trained a linear classifier for each brain area, to do animal/nonanimal categorization based on the patterns of brain responses to the images. **Result** In some of the key brain regions, such as R-parahippocampus and R-fusiform, overlapping with early tau-pathology (Braak, Alafuzoff et al. 2006), both HC and MCI showed a significantly higher level of mean brain activity in response to all images compared to the AD group ($p\text{-value} < 0.0001$). Additionally, looking at the patterns of brain activity in the L-fusiform, HC and MCI could be discriminated based on their MVPA responses ($p\text{-value} < 0.00015$), while there was no univariate difference between the two groups.

The inflammatory hypothesis of depression (Elham Bakhtiyari)

The most common emotional disorder characterized by decreased desire and loss of pleasure and interest is depression. Depression has been identified as a major cause of disability by the World Health Organization. This disorder leads to huge economic costs and suicide disaster as the most severe result. Little success has been achieved in discovering effective drugs in the treatment of depression, which is due to insufficient understanding of the underlying biology of this disorder, which indicates the need for extensive research in this field. One of the hypotheses proposed for depression is its inflammatory hypothesis, and one of the factors that plays a major role in this approach is the inflammasome complex, which eventually causes pyroptosis as a result of its activation. Among the factors that activate this complex is stress. Since less attention has been paid to the initial stages, that is, when stress reactions and immune responses begin, the necessity of conducting research in this field is identified.

Our research team under the guidance of Professor Gholamreza Hassanzadeh has conducted valuable studies on the inflammasome complex and has recently started research in the field of stress-induced depression in the Tehran University of Medical Sciences, School of Advanced Technologies in Medicine and it has created the platform for further investigations, both in understanding the mechanism of disease and the discovery of effective drugs in the treatment of the disease.

Zebra Finch as an animal model in neuroscience (Zohreh SafarCharati)

Humans are often thought to be unique in their linguistic abilities. More recently, behavioral, neuroanatomical and genetic similarities between the human language system and several other specie were found, most notably in songbirds. Evidence shows that songbirds learn their songs. This learning has striking parallels to speech acquisition: like humans, birds must hear the sounds of adults during a sensitive period, and must hear their own voice while learning to vocalize. With the discovery and investigation of discrete brain structures required for singing, songbirds are now providing insights into neural mechanisms of learning. Aided by a wealth of behavioral observations and species diversity, studies in songbirds are addressing such basic issues in neuroscience as perceptual and sensorimotor learning, developmental regulation of plasticity, and the control and function of adult neurogenesis. In this presentation, I will explain the place of the zebra finch animal model in neuroscience studies.