مباحثی در ریاضیات زیستی

کارگاه آموزشی (۱)

۷ الی ۱۱ دی ماه ۱۳۸۹

اسامی برگزارکنندگان:

- **روزبه توسرکانی، پژوهشگاه دانشهای بنیادی**
- **عبدالحسین عباسیان، پژوهشگاه دانشهای بنیادی**
- **سید رضا مقدسی، دانشگاه صنعتی شریف و پژوهشگاه دانشهای بنیادی**

۱. برنامه سخنرانی ها:

	سه شنبه ۱۳۸۹/۱۰/۷	چهارشنبه ۱۳۸۹/۱۰/۸	پنج شنبه ۱۳۸۹/۱۰/۹	جمعه ۱۳۸۹/۱۰/۱۰	شنبه ۱۳۸۹/۱۰/۱۱
۹:۰۰–۱۰:۰۰	ثبت نام	آرش افراز	بهادر بهرامی	امیر اسدی	بهادر بهرامی
۱۰:۰۰–۱۰:۳۰	تنفس	تنفس و پذیرایی	تنفس و پذیرایی	تنفس و پذیرایی	تنفس و پذیرایی
۱۰:۳۰–۱۱:۳۰	آرش افراز	**Vision Demo**	بهادر بهرامی	امیر اسدی	آرش یزدان بخش
۱۱:۳۰–۱۲:۰۰	پرسش و پاسخ		پرسش و پاسخ	پرسش و پاسخ	پرسش و پاسخ
۱۲:۰۰–۱۴:۰۰	نهار	نهار	نهار	نهار	نهار
۱۴:۰۰–۱۵:۰۰	آرش افراز	یاسر رودی (ویدئو کنفرانس)	سخنرانی دانشجویی **Introduction to Memory**	سخنرانی دانشجویی **Introduction to Memory**	آرش یزدان بخش
۱۵:۰۰–۱۶:۰۰	مریم وزیری	یاسر رودی (ویدئو کنفرانس)			آرش یزدان بخش
۱۶:۰۰–۱۶:۳۰	تنفس و پذیرایی	تنفس و پذیرایی			تنفس و پذیرایی
۱۶:۳۰–۱۷:۳۰	مریم وزیری	سخنرانی دانشجوئی **(Neuronal Spike-Train Analysis, A Case Study)**			آرش یزدان بخش

۲. عناوین و چکیدهٔ سخنرانی ها:

آرش افراز، *ام.آی. تی.، آمریکا*

- Spatial limits of object processing in brain
- Spatial heterogeneity in the perception of face and form attributes. A new theoretical approach to Translation invariance
- Physiological underpinnings of face representation in the primate brain

Abstract:
The identity of an object is independent of where it appears in the visual field. According to one of the classical tenets of the vision science, the visual system captures this invariance. Large receptive fields of neurons in the higher brain areas are believed to mediate this translation invariance. Based on converging evidence from various experiments, many assumptions of this traditional view are challenged here. A series of experiments has demonstrated that translation invariance and homogeneity of the visual perception are more pronounced for lower level visual features that are presumably encoded by neurons with smaller receptive fields. Using "face adaptation" paradigm, it is shown that the functional analysis region for face processing is much smaller than what has been thought. These results also show that face processing is based in retinotopic coordinates across head and eye movements. These new findings suggest a totally different doctrine for the more modestly named function; "translation tolerance". According to the new proposal, translation tolerant object recognition is not necessarily the result of big receptive fields of neurons in the higher brain areas. Translation tolerance is perhaps a matter of learning, calibration and statistical sampling of separate object/feature selective units according to this new view.

امیر اسدی، *دانشگاه ویسکانسین-مدیسون، آمریکا*

- Biological complexity of gene networks: Towards a quantitative theory
- Model reduction in complete dynamical networks

Abstract:
Complex dynamical systems are ubiquitous. Major questions in biology, such as the origin of life and its evolution into uncountable forms and behaviors in living organisms have been investigated concurrent with intellectual contributions to the science of complex systems. Our progress in understanding biological intelligence is tied to the depth and versatility of quantitative models of complex dynamics in the relevant organisms. Quantifying variation in phenotypic and genotypic traits in organisms within a single genotype is regarded as the quintessential problem facing progress in understanding the nature and properties of the complex dynamics in biological systems.

A novel view towards understanding variation in traits is to regard variation in phenotypic traits and diversity of the forms of behavioral response to similar stimuli as results of many different forms of "Biological Computations" that take place in a biological system, despite all being qualified as "valid biological programs" for the "same set of genomic algorithms" that are encoded within a single genotype and stabilized through natural selection and other evolutionary mechanisms.

Thus, we are led to an old and challenging problem in theoretical biology, namely, to characterize Biological Computation rigorously, and to develop the subsequent concepts that would lead to classification and description of various forms of biological computation that implement “computationally equivalent forms of genomic algorithms”. A magnificent example that brings together all the above‐mentioned considerations is the animal brain. With no exaggeration, the animal nervous system is the most studied complex dynamical system to date. The outstanding problem in neuroscience is notorious task of identifying brain activities and the animal behavior as emergent forms of biological computation.

A quantitative theory of Biological Complexity could be regarded as an essential step that provides insight into the biological nature of the types of events that comprise distinct cases of Biological Computation that implement equivalent genomic algorithms, whether in brain or any other intelligent biological system. Thus, Biological Complexity could be regarded as the first systematic numerical measure of variation of phenotypic traits in organisms within the same genotype.

The first lecture lays out the biomolecular panorama for development of a computationally tractable theory of biological complexity. The second lecture outlines the mathematical challenges that arise in extending such a theory from the molecular scale to the neuronal and behavioral domains.

This research is a result of contributions by several students and collaborators in Iran and UW Madison.

بهادر بهرامی، *یو. سی. ال.، انگلستان*

- Individual differences in human behavior and the relationship to brain structure I, II

Abstract:

Human Parietal Cortex Structure Predicts Individual Differences in Perceptual Rivalry

When visual input has conflicting interpretations, conscious perception can alternate spontaneously between competing interpretations. There is a large amount of unexplained variability between individuals in the rate of such spontaneous alternations in perception. We hypothesized that variability in perceptual rivalry might be reflected in individual differences in brain structure, because brain structure can exhibit systematic relationships with an individual's cognitive experiences and skills. To test this notion, we examined in a large group of individuals how cortical thickness, local gray-matter density, and local white-matter integrity correlate with individuals' alternation rate for a bistable, rotating structure-from-motion stimulus. All of these macroscopic measures of brain structure consistently revealed that the structure of bilateral superior parietal lobes (SPL) could account for interindividual variability in perceptual alternation rate. Furthermore, we examined whether the bilateral SPL regions play a causal role in the rate of perceptual alternations by using transcranial magnetic stimulation (TMS) and found that transient disruption of these areas indeed decreases the rate of perceptual alternations. These findings demonstrate a direct relationship between structure of SPL and individuals' perceptual switch rate.

Reference: Ryota Kanai, Bahador Bahrami, Geraint Rees. Human Parietal Cortex Structure Predicts Individual Differences in Perceptual Rivalry. Current Biology - 28 September 2010 (Vol. 20, Issue 18, pp. 1626-1630)

- Collective decision-making

Abstract:
How to "see" the elephant in the dark: social interaction afford reliable belief formation even in the absence of objective knowledge
Sensory perception is noisy and incomplete. Therefore, our beliefs about physical events that give rise to perception have limited reliability. This limitation is beautifully portraied by Rumi in the story of "the elephant in the dark": each observer's description of the elephant is far from the truth and severely constrained by his limited sensory sample. Rumi concluded that "light" (ie external source of objective knowledge) is necessary for formation of a reliable belief. In my talk I will challenge this notion and provide empirical evidence arguing that if Rumi's protagonists had talked to each other and shared their experience via social interaction, they could have come to a description of the elephant as accurate as if they had had access to light. I will also discuss the implications of this finding for social learning in different cultural contexts by comparing European and Chinese observers.
Reference: Bahrami, B., Olsen, K., Latham, P. E., Roepstorff, A., Rees, G., Frith, C. D. (2010). Optimally interacting minds. Science, 329 (5995). 1081-1085

یاسر رودی، *موسسه کاولی، نروژ*

- Mean Field Theory for Inferring Real and Functional Interactions in Neural Networks I, II

The talks would be mainly based on:

1. Roudi Y., Hertz J. (2010)
Mean Field Theory for Non-equilibrium Network Reconstruction
arXiv:1009.5946v1 [cond-mat.dis-nn]

2. Hertz J., Roudi Y., Thorning A., Tyrcha J., Aurell E., Zeng H. (2010)
Inferring network connectivity using kinetic Ising models,
BMC Neuroscience 2010, 11(Suppl 1):P51

3. Roudi Y., Tyrcha J., Hertz J. (2009)
Ising Model for Neural Data: Model Quality and ApproximateMethods for Extracting Functional Connectivity,
Phys. Rev. E, 79, 051915

مریم وزیری، *دانشگاه هاروارد، آمریکا*

- Perception of speed and position at low luminance
- Dissociation of perception and action at low luminance
- Vision Demo

Abstract:
The perception of the speed of moving objects and guiding motor reactions to them is a crucial task of the visuomotor system that has to be performed across dramatic changes in luminance in everyday life. In a series of studies we demonstrate that the perceived speed of motion is significantly (up to 30%) overestimated at low luminance. This speed overestimation is a result

of lengthened motion smear that is caused by an increase in visual persistence at low luminance. However, we find next that this change in perceived speed does not affect other speed-dependent responses: neither motion-induced position shifts (the flash lag effect) nor speed-dependent motor responses (eye and hand movements) are affected by variations in luminance that have large and significant effects on perceived speed. In conclusion multiple cues, including motion smear, may contribute to the perception of speed, but not all of them contribute to determining the position of and guiding responses to moving targets. The cues that do participate appear to be invariant to wide ranges of luminance.

آرش یزدان بخش، *دانشگاه بوستون، آمریکا*

- The mystery of mid-level vision and beyond

Abstract:
Mid-level vision may not be a well-defined concept, yet multiple efforts to describe and test the perception of basic geometrical and physical properties of objects through visual system grouping and competitive mechanisms related to phenomena like surface appearance, transparency, and glowing illusions like neon-color spreading entertained many for quite a while. Psychophysical-microelectrode-type experiments related to binocular rivalry and disparity-based depth engaged psychophysicist and electrophysiologist into getting a handle over the temporal and spatial aspects of related neural responses. However, single-cell and imaging studies show that these phenomena could have their neural signature in multiple visual areas, inspiring modelers to seek a variety of grouping and synaptic habituation mechanisms all over to fit the temporal and spatial parameters of candidate models.
I will partially explore a few modeling, electrophysiological, and psychophysical studies relevant to the above struggles.

- Topics in modeling, psychophysics, and electrophysiology I, II, III

In the presentation, I will give a tour to the modeling work:

Grossberg, S. and A. Yazdanbakhsh, Laminar cortical dynamics of 3D surface perception: stratification, transparency, and neon color spreading. Vision Res, 2005. 45(13): p. 1725

To cover the phenomenology of transparency and neon color spreading and then offer a tour of laminar structure based on shunting equations and network. This is rather intended to fulfill the curiosities related the shunting equations, properties and how to wire things to be consistent with the psychophysical findings and also not to be inconsistent with physiological findings. Of course there are “hidden” assumptions in such an endeavor for which the audience are encouraged to dig out, criticize and discuss.

Then I will sweep the work with Takeo Watanabe about the engineering a stimulus for stereopsis and 3D vision. It has a bit inspiration form modeling work, but independently can be considered a pure psychophysics work:

Yazdanbakhsh, A. and T. Watanabe, Asymmetry between horizontal and vertical illusory lines in determining the depth of their embedded surface. Vision Res, 2004. 44(22): p. 2621

EQUIPMENT: If some students are interested in stereo-vision, I encourage setting up a stereoscope (haploscope) in a room to check all of the stereograms in the above paper. If some students have the ability to cross-fuse, even better!

Then we proceed quickly to the electrophysiology work and some examples of spike-triggered cross-correlation:

Yazdanbakhsh, A. and M. S. Livingstone (2006). "End stopping in V1 is sensitive to contrast." Nature Neurosci 9(5): p.697-702.

This can be interesting definitely from a modeling view point.

Then we can continue our tour with a psychophysical work about surface and depth with the flavor of neon color spreading, ALL IN ONE, DEAL…

Nishina, S., A. Yazdanbakhsh, et al. (2007). "Depth propagation across an illusory surface." J Opt Soc Am A Opt Image Sci Vis 24(4): 905-10.

If some student is interested, we can talk/plan about the next step in such a study and do a pilot study in the potential room with haploscope there, if someone is interested to replicate the dynamical stereogram, even better…

Could one measure the receptive field size psychophysically? No, yes, no, yes, … (might you remember Gholi va Madar-bozorg), seems I am getting Gholi a bit….

Yazdanbakhsh A. and Gori, S. (2008) A new psychophysical estimation of the receptive field size, Neuroscience Letters, 438(2): 246-251.

This work makes several assumptions, yet on its own can be considered a rare one. If some students are more interested toward this direction, they are encouraged to do paper/screen demo and play with different variants, and even include stereopsis. For more versions they can consult this one:

Gori, S. and A. Yazdanbakhsh (2008) The Riddle of the Rotating Tilted Lines Illusion. Perception, 37(4): 631-635.

Hardcore gentlemen interested in the perception of depth with minimal stimulus condition? Go with this:

Léveillé J., Yazdanbakhsh A. (2010). Speed, more than depth, determines the strength of induced motion, Journal of Vision, 10(6):10, 1-9

What can be done practically in the class? Well Emmert’s law game, we can do paper and pen game with that and get more and more confused with depth perception and even feel that the above article helps substantial confusion toward the understanding of depth perception.

لیست شرکت کنندگان نهایی

No.	Name	Family Name	Affiliation	Field of Study
1	Parastou	Abbasi	Amirkabir University of Technology	Computer Science
2	Abdolhosein	Abassian	IPM	Cognitive Sciences
3	Nima	Abedpour	IPM	Physics
4	Mohammad Reza	Abolghasemi	IPM	Cognitive Sciences
5	Mohadese	Adabi Mohazab	University of Tehran	
6	S. Reza	Afraz	MIT, USA	M.D., Ph.D.
7	Samira	Aghayee	Amirkabir University of Technology	Mathematics
8	Ali	Ahari	Sharif University of Technology	Computer Engineering
9	Siavash	Ahmadi	Sharif University of Technology	Computer Science
10	Emad	Ahmadi	University of Tehran	Medical
11	Hessameddin	Akhlaghpour	Sharif University of Technology	Computer Engineering
12	Elyar	Alizadeh	Allameh Helli High School	
13	Mohsen	Arian Nik	Shahid Beheshti University	Medical
14	Amir	Assadi	University of Wisconsin-Madison	Mathematics
15	Saeedeh	Babaii	Sharif University of Technology	Physics
16	Bahador	Bahrami	University College London, UK	M.D, Ph.D.

17	Fatemeh	Bakouie	Amirkabir University of Technology	Biomedical Engineering
18	Mona	Bayat	Sharif University of Technology	Physics
19	Milad	Ekramnia	University of Isfahan	Physics
20	Moein	Esghaei	IPM	Cognitive Sciences
21	Mina	Ekramnia	Sharif University of Technology	Physics
22	Niloofar	Farajzadeh	University of Tehran	Mathematics
23	Tara	Farzami	University of Tehran	Mathematics
24	Zeinab	Fazlali	IPM	Cognitive Sciences
25	Sadegh	Feiz	Sharif University of Technology	Physics
26	Tara	Ghafari	Shahid Beheshti University	Medical
27	Reza	Ghanbarpour	Sharif University of Technology	Computer Science
28	Aida	Hajizadeh	Amirkabir University of Technology	Physics
29	Seyed Naser	Hashemi	Amirkabir University of Technology	Mathematics
30	Akram	Heidari	Islamic Azad University, Izeh	Mathematics
31	Maziar	Heidari	Sharif University of Technology	Mechanical Engineering
32	Aghileh	Heydari	Payame Noor University of Mashhad	
33	Vahid	Hoghooghi	Tehran University of Medical Science	Medical

34	Shayan	Hosseiny	Allameh Helli High School	
35	Ehsan	Irani	Sharif University of Technology	Physics
36	Omid	Jadidoleslam		
37	Mina	Jamshidi	Bahonar University of Kerman	Mathematics
38	Hoda	Javadi	University of Tehran	
39	Amir	Judaki	Sharif University of Technology	Computer Engineering
40	Pegah	Kahali	University of Tehran	Medical
41	Nasrin	Kahkeshani	Qom University	Mathematics
42	Danesh	Kajbaf	University of Tehran	Medical
43	Hassan	Kangarani Farahani		
44	Elnaz	Karami	University of Tehran	Biology
45	Ali	Kashi	Sharif University of Technology	Physics
46	Mohammad Hassan	Khabbazian	Sharif University of Technology	Computer Science
47	Ahmad Reza	Khadem	IPM	Computer Science
48	Seyed-Mahdi	Khaligh-Razavi	University of Tehran	Computer Engineering
49	Zahra	Khalili	IPM	Cognitive Sciences
50	Ali	Khezeli	Sharif University of Technology	Mathematics
51	Mohammad	Kianpour	Guilan University	Mathematics
52	Hadi	Maboudi	IPM	Cognitive Sciences
53	Amin	Mahnam	IPM	Electrical Engineering
54	Iman	Mahyaeh	Sharif University of Technology	Physics

55	Masoud	Majed	University of Tehran	Medical
56	Maryam	Malekpour	Alzahra University	Mathematics
57	Peyman	Mani	Amirkabir University of Technology	Computer Engineering
58	Mahdi	Mazaheri	Sharif University of Technology	Electrical Engineering
59	Saghar	Mirbagheri	Shahid Beheshti University	Medical
60	Mehdi	Mirzaie	Shahid Beheshti University	Mathematics
61	S. Reza	Moghadasi	Sharif University of Technology and IPM	Mathematics
62	Mahsa	Mohammadi Kaji	Sharif University of Technology	Computer Engineering
63	Zahra	Mokhtari	Sharif University of Technology	Physics
64	Ali	Nadalizadeh	Amirkabir University of Technology	Computer Engineering
65	Isar	Nejadgholi	Amirkabir University of Technology	Biomedical Engineering
66	Donna	Parizade	Shahid Beheshti University	Medical
67	Morteza	Pishnamazi	University of Tehran	Medical
68	Nima	Pourdamghani	Sharif University of Technology	Computer Engineering
69	Nafiseh	Rafiei	Amirkabir University of Technology	Physics
70	Safura	Rashid-Shomali	IPM	Cognitive Sciences
71	Neda Sadat	Rasooli	Shahid Beheshti University	Mathematics

72	Hossein	Razizadeh	Sharif University of Technology	Computer Science
73	Elham	Roshanbin	Isfahan University of Technology	Mathematics
74	Yasser	Roudi	Kavli Insitute for Systems Neuroscience, NTNU	Physics
75	Ehsan	Sabri	University of Tehran	Electronic, Electrical & Computer Engineering
76	Saeid	Sadri	IASBS	Mathematics
77	Mohammad-Karim	Saeed-Ghalati	Sharif University of Technology	Physics
78	Shervin	Safavi	University of Tehran	Physics
79	Atena	Sajedin	IPM	
80	Niloufar	Salehi	Sharif University of Technology	Computer Engineering
81	Fazeleh	Salehi	Amirkabir University of Technology	Mathematics
82	Amir	Sepehri	Sharif University of Technology	Mathematics
83	Behrang	Sharif	University of Tehran	Medical
84	Amir Hossein	Shirazi	Tehran University of Medical Science	Medical
85	Ehsan	Tadayyon	University of Tehran	Medical
86	Moujan	Tofighi	Amirkabir University of Technology	Mathematics
87	Tahereh	Toosi	IPM	Cognitive Sciences

88	Rouzbeh	Tusserkani	IPM	Mathematics
89	Hossein	Vahabi	IPM	Cognitive Sciences
90	Maryam	Vaziri Pashkam	Harvard University, USA	M.D., Ph.D.
91	Farbod	Yadegarian	Allameh Helli High School	
92	Arash	Yazdanbakhsh	Boston University, USA	M.D., Ph.D.
93	Mohammad Mahdi	Yazdi	Sharif University of Technology	Mathematics
94	Pooya	Zakeri	IPM	Computer Engineering

Timetable for the workshop on “Introduction to Memory”

برنامه سخنرانی های دانشجویی

Thursday, 30 December 2010 9 Dey 1389		
14:00 - 14:45	**1. Introduction to memory**	**Masoud Majed**
15:00 - 15:45	**2. Microcircuits of hippocampus**	**Pegah Kalali**
16:00 - 17:15	**3. Place cell – Grid cell**	**Ehsan Tadayon – Danesh Kajbaf**
17:30 - 18:30	**Preliminary workshop: anatomy and hippocampus**	
Friday, 31 December 2010 10 Dey 1389		
14:00 - 14:45	**4. Familiarity versus Recollection**	**Masoud Majed**
15:00 - 15:45	**5. Molecular basis of memory**	**Danesh Kajbaf – Ehsan Tadayon**
16:00 - 16:30	**6. Contextual cueing**	**Masoud Majed**
16:30 - 18:30	**Main memory: memory and psychophysics**	

چکیده مطالب

۱. حافظه در مغز؟

خصوصیات عجیب حافظه موجود درسیستم‌عصبی جانداران نشان می‌دهد مکانیسم ذخیره اطلاعات بسی پیچیده‌تر از ذخیره‌کردن داده‌ها در یک hard disk است.

گرچه بر اساس مطالعات اولیه برروی بازیابی اطلاعات بیمارانی که دچار ضایعات وسیع در مغز شده بودند این‌چنین قلمداد می‌شد که حافظه در هر جایی از مغز می‌تواند ذخیره شود، در دهه ۱۹۵۰مشاهده نوعی خاص از اختلال حافظه در بیماری با نام مستعار .H.M معادلات را برهم زد. در واقع William Scoville جهت کنترل تشنج، بخشی کوچک از قسمت میانی لوب تمپورال هر دو طرف چپ و راست را از مغز .H.M خارج کرد و پس از عمل جراحی شاهد اختلالات وسیع حافظه بود. Scoville با کمک Brenda Milner و بر اساس آزمون‌های مختلف نشان دادکه اختلال صرفاً در انواعی خاص از حافظه رخ داده است.

پس از آن بود که محققین با الهام از اختلالات مشاهده شده در .H.M در مطالعات خود انواع مختلف حافظه و محل ذخیره احتمالی آنها را شناسایی کردند.

در اینجا سعی داریم برخی از انواع اصلی حافظه و مناطق ذخیره آنها در مغز را بررسی کنیم.

۲. Microcircuits of hippocampus

Hippocampus را می توان یکی از جالب توجه ترین ساختارهای سیستم اعصاب مرکزی دانست.اگرچه Hippocampusدر ادامه cortex (قشر) مغز شکل می گیرد ساختار ساده تری نسبت به neocortex دارد.این ساختار ۳ لایه ای در طول تکامل حفظ شده است. سادگی این ساختار تحقیقات هر چه بیشتر بر روی Hippocampus را ممکن ساخته است تا آنجا که بسیاری از مبانی پایه علوم اعصاب برای اولین بار در این قسمت شناسایی شده و پس از آن به دیگر ساختارهای مغزی نیز تعمیم داده شده است. بنابراین شاید شناخت اناتومی و ارتباطات مناطق hippocampus دری باشد برای ورود به دنیای مغز!

۳. خمیدگی فضا درحافظه!!

در سال ۱۹۷۴ John O'keefe موفق به کشف نورون هایی در هیپوکامپ شد که تنها محرک فعالیت آنها قرارگیری در "مکان" خاصی از فضا بود. او این سلول ها راplace cell نامید. کشف این سلول ها نظریه ترسیم نقشه ای از فضای پیرامون را درهیپوکامپ مطرح کرد.

اخیراً سلول هایی کشف شده اند که فضا را به شبکه ای از شش ضلعی ها تقسیم میکنند.این سلولها که Grid نامیده میشوند احتمالا ابزار لازم برای شکل گیری این نقشه فضایی را فراهم میکنند.

۴. چهره شما به نظرم آشناست ولی نمیدانم کجا شما را دیده‌ام....

همه ما بارها این جمله را به زبان آورده‌ایم و با وجود تلاش زیاد به یاد نیاوردیم که فرد مخاطب را کجا و در چه شرایطی ملاقات کرده‌ایم . بدتر آنکه با به یاد نیاوردن جزئیات، در صحت اینکه فرد مخاطب واقعاً آشناست یا نه شدیداً تردید می‌کنیم تا اینکه مخاطب با اطمینانی خاص دوران خوش شما در دبستان را به یادمان می‌آورد.

اینکه تفاوت این دو نوع یادآوری خاطرات صرفاً تفاوت در قدرت یادآوری است ویا اینکه این دو اساساً دو روند مجزا با مکانیسم‌های نورونی متفاوت است از دهه‌های گذشته چالشی جذاب برای محققین بوده است. چرا که پاسخ آن تلقی ما از سیستم‌های دخیل در یادآوری و حتی ذخیره اطلاعات را تحت تآثیر قرار می‌دهد.

در اینجا سعی داریم نظریات رایج در مورد این دو نوع یادآوری را به صورت اجمالی بررسی کنیم.

۵. حافظه مولکولی؟!

"تخریب حافظه: مرگ یک نورون یا نسل کشی نورون ها؟ "

حافظه نتیجه ی برهم کنش شبکه ای از سلول های عصبی است؛ با آنکه هرسلول دارای تمام اطلاعات مربوط به یک حافظه می باشد ولی با مرگ آن سلول اطلاعات مربوط به آن حافظه از بین نمیرود.

محل برهم کنش میان نورون ها سیناپس نامیده می شود. چگونگی ترجمه زبان مولکول ها در سیناپس به مفهوم حافظه یکی از بحث برانگیزترین موضوع های علوم اعصاب می باشد.

در اینجا سعی داریم تعدادی از مکانیسم هایی را که میتوانند در شکل گیری حافظه نقش داشته باشند بررسی کنیم.

۶. حافظه ما از محیط: کمکی برای یافتن اشیا در محیط

به این سناریو توجه کنید:

"عصر هنگام وارد اتاق همیشه نامرتب و شلوغ خود می‌شوید ولی قبل از ورود شما مادرتان اتاق را مرتب کرده است. اما این موضوع شما را شدیداً عصبانی کرده چراکه جزوه‌های امتحان فردای خود را پیدا نمی‌کنید. با سروصدای شما مادرتان وارد اتاق شده و با مهربانی به شما نشان می‌دهد که محل جزوه‌های امتحانی شمادست‌کاری نشده و فقط بقیه وسایل مرتب شده‌اند. شما با وجود آنکه واقعاً نمی‌توانستید جزوه‌های امتحانی را پیدا کنید جوابی ندارید....."

در اینجا سعی می‌کنیم با بیان آنچه jiang و chun در سال ۱۹۹۸ contextual cueing نامیدند حق را به شما بدهیم.

Neuronal Spike-Train Analysis, A Case Study

Hessameddin Akhlaghpour

Using simultaneous recordings of neurons in different brain regions of a macaque performing visual tasks, I intend to explore methods and techniques that attempt to analyze neuronal spike trains. Various pattern recognition methods may be used to classify spike trains. I will primarily focus on utilizing Bayesian inference to extract stimulus information from neural codes. Through analysis of this data we can observe traces of visual stimuli coding during the delay period were the visual stimulus has disappeared. This gives us insight on how working memory might function in the brain. In addition, analysis of repeated recordings of single neurons can be helpful in comparing firing rate models with spike timing models, and determining whether it is the temporal pattern that codes information or simply spike frequency. In this talk I will demonstrate several elementary effects observed in neuronal codes which can give us insight in how neurons behave.