We use the model and the dynamic measure of discriminability to characterize how the reliability and speed of discrimination depends on parameters of the STRF.

335 (T16)

A Recurrent Network Model of Eye-Position Effect on Auditory Receptive Field

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Visual and auditory systems use different reference frames to code stimuli early vision is eye-centered, while early audition is head-centered. To direct saccade towards an auditory target, auditory signals have to be transformed into eye-centered coordinates in the superior colliculus (SC), where auditory receptive fields (RF) can indeed be shifted with the eyes. We propose a recurrent network model with separate excitatory and inhibitory neuronal populations for combining the incoming signals using the approximate multiplicative property of the network. The model may provide a robust and biologically more realistic computational mechanism for the eye-position effects.

336 (T17)

Excitation and Inhibition in Bat Azimuthal Echolocation

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Bats use interaural level differences (ILD) as their primary cue for azimuthal echolocation. ILD information is processed in the bats brainstem through cells that receive excitation from one ear and inhibition from the other ear (called EI cells). In this paper, we model bats three ILD processing centers - the lateral superior olive (LSO), the dorsal nucleus of the lateral lemniscus (DNLL) and the inferior colliculus (IC), with a three layer feedforward spiking neural network. We also present a very large scale integrated (VLSI) circuit based neuromorphic system that mimics ILD processing in the bat LSO.

337 (T18)

Phasic, tonic, and mixed mode firing of an auditory neuron model -- bifurcation analysis

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Temporal processing, such as coincidence detection, on sub-msec time scales by auditory brain stem neurons is enhanced by a low-threshold potassium current (IKLT). IKLT also helps to make the neurons (e.g. in the medial superior olive, MSO) fire phasically rather than tonically. In response to a step of current (Iapp) MSO cells typically fire a single spike at stimulus onset but not tonically for the maintained current or for a slow ramp of Iapp. We have studied the response properties of an HH-like model that incorporates an IKLT. The model shows phasic behavior over a large range of parameters. But for reduced IKLT strength tonic firing is elicited by an adequate step of Iapp. Curiously, the model does not fire if Iapp is very slowly ramped through this entire range of Iapp. The behavior is explained by using bifurcation theory the rest state is stable for all Iapp but there is a coexistent limit cycle for some Iapp range. This mixed mode

behavior leads to spike patterns that appear bursty (with high CV) when the model is driven periodically in the presence of noise.

338 (T19)

Neural mechanism of detecting interaural intensity differences in the owl's auditory brainstem for sound location

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In order to clarify the neural mechanism of detection of the interaural intensity difference(IID), we presented a neural model of a pair of VLVp units (the first site of binaural convergence of intensity information). We proposed that each value of IID is represented as a neuronal position of a firing zone gap which is generated in ICc shell by combining output of right VLVp with that of left VLVp. Based on this gap coding scheme, we clarified the functional role of the mutual inhibitory connections between R- and L- VLVp and of bilateral inhibitory projection from VLVp pair to ICc shell.

339 (T20)

Empirical Mode Decomposition A Method for Analyzing Neural Data

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Almost all measurements in neurobiology are stochastic and nonstationary. Conventional methods to use these measurements to provide a meaningful and precise description of complex neurobiological phenomenon are insufficient. Here, we report on the use of Huangs data-driven Empirical Mode Decomposition (EMD) method (Huang et al. 1998a) to study neuronal activity in visual cortical area V4 of macaque monkeys performing a visual spatial attention task (Fries et al. 2001). We found that Local Field Potentials were resolved by the EMD into the sum of a set of intrinsic components with different degrees of oscillatory content. High-frequency components were identified as gamma band (35-90 Hz) oscillations, whereas low-frequency components in single-trial recordings contributed to the average visual evoked potential (AVEP). We also discovered that the magnitude of time-varying gamma activity was enhanced when monkeys attended to a visual stimulus as compared to when they were not attending to the same stimulus. These results support the idea that the magnitude of gamma activity reflects the modulation of V4 neurons by visual spatial attention. The EMD, coupled with instantaneous frequency analysis, may prove to be a vital technique for the analysis of neural data.

340 (T21)

Rapid temporal modulation of synchrony in cortical interneuron networks with synaptic depression

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The synchrony of neurons in extrastriate visual cortex is modulated by selective attention even when there are only small changes in firing rate. We used Hodgkin-Huxley type models of