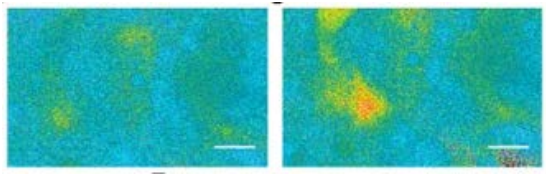
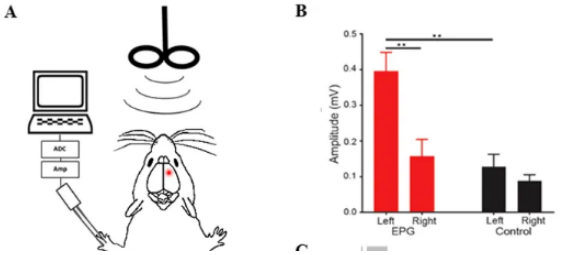
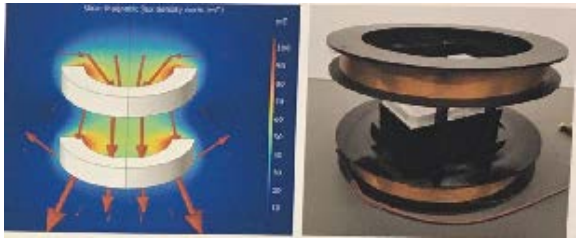
Magnetogenetics



In vitro calcium images of fura - 2/AM loaded HEK cells before and after 10 s of magnetic stimulation





Electromagnetic Perceptive Gene (EPG) expression in the hippocampus reduces seizure activity in a kainic acid rat model of acute epilepsy

Abigael Metto[1,3], Ryan Ashbaugh[2,3], Galit Pelled[1,3]

Department of Biomedical Engineering, Department of Electrical & Computer Engineering and Institute for Quantitative Health Science and Engineering

Michigan State University, East Lansing, MI 48823

INTRODUCTION

- Medial temporal lobe epilepsy (TLE) is the most prevalent form of epilepsy with focal onset seizures.
- Thirty percent of patients do not respond to anti-epileptic drugs and are not good candidates for resective surgery. For these patients, neuromodulation strategies including deep brain stimulation and vagus nerve stimulation have shown success.
- However, these procedures are very complex and may pose serious risks to the patients.
- We propose a novel, non-invasive, gene-based intervention to alleviate seizure frequency and severity

Figure 1. EPG characterized in Kryptopterus bicirrhis

- Our laboratory has newly discovered a gene in the glass catfish, the electromagnetic perceptive gene (EPG) which responds to magnetic fields[1]

HYPOTHESIS

- When a seizure happens, there is an abnormal firing of neuronal populations
- We hypothesize that the electric current produced by these neuronal networks induces a magnetic field that activates the EPG, which subsequently suppresses seizures or prevents them from further spreading, in a closed-loop fashion.

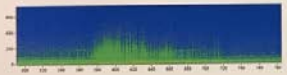


Figure 2. Spectrogram representing seizure activity

Figure 3. Spiking activity during seizures

METHODS

- Our approach utilized an acute kainic acid (KA) model of TLE in adult Wistar Furth rats.
- Study population consisted of 6 animals in the experimental group and 8 animals in the control group

Stereotaxic delivery of EPG/ Control virus into right hippocampus

↓ (2-3 weeks)

In vivo Electrophysiology

↓

Histology

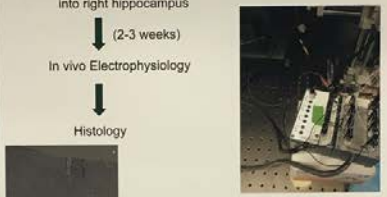


Figure 4. Electrophysiology setup

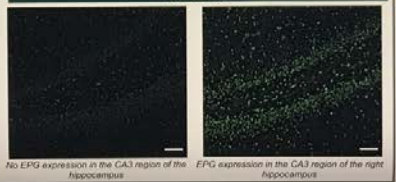
Figure 5. Electrode tract in the right hippocampus

- Seizure detection was performed in MATLAB

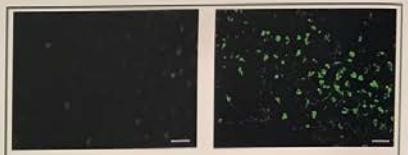
Parameters for seizure detection in MATLAB

Min. Interspike interval	Max. interspike interval	# of spikes in a train	Min. Train duration
0.05s	3s	4	7.5s

RESULTS



No EPG expression in the CA3 region of the hippocampus | *EPG expression in the CA3 region of the right hippocampus*



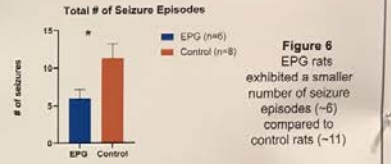


Figure 6 EPG rats exhibited a smaller number of seizure episodes (~6) compared to control rats (~11)

Figure 7 Seizures lasted longer in non-EPG rats compared to EPG rats

DISCUSSION

- **Results indicate that EPG expression in the hippocampus results in a significant reduction in the total number of seizure episodes and the total duration of seizures**

REFERENCES

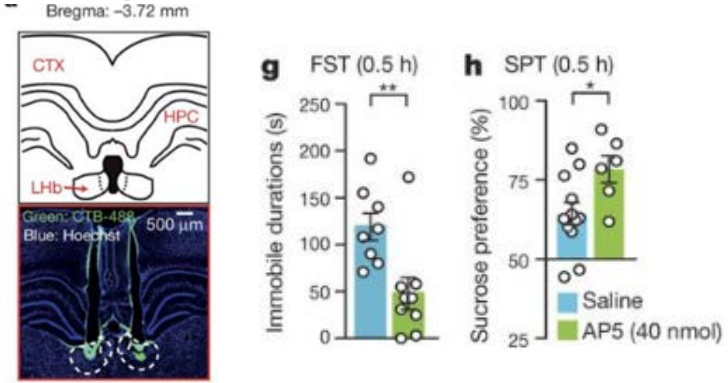
Krishnan, V., Park, S. A., Shin, S. S., Alon, L., Tressler, C. M., Stokes, W., ... Pelled, G. (2018). Wireless control of cellular function by activation of a novel protein responsive to electromagnetic fields. *Scientific Reports*, *8*(1). doi: 10.1038/s41598-018-27087-9

ACKNOWLEDGEENTS

This work was supported by NIH/NINDS R01NS096231

Hailan Hu lecture

Figure 1: Local blockade of NMDARs in LHb is sufficient to elicit rapid antidepressant effects.



Hailan Hu lecture

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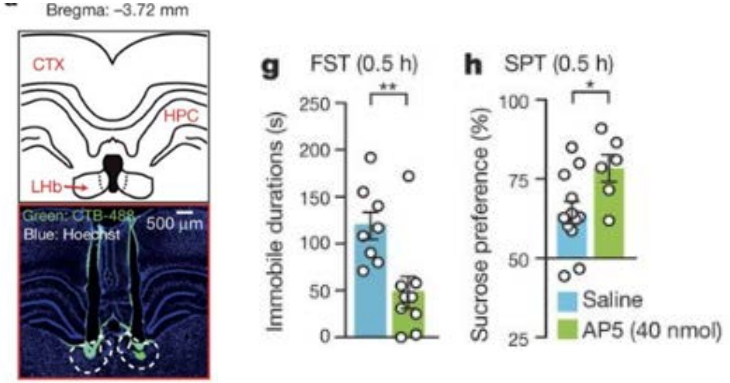
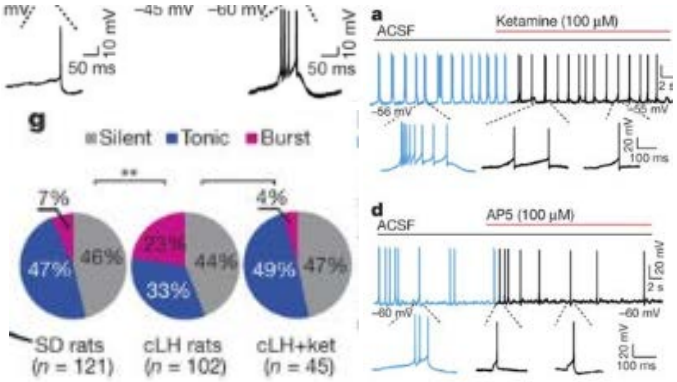


Figure 2: Ketamine suppresses enhanced LHb bursting activity and theta-band synchronization in animal models of depression.



Hailan Hu lecture

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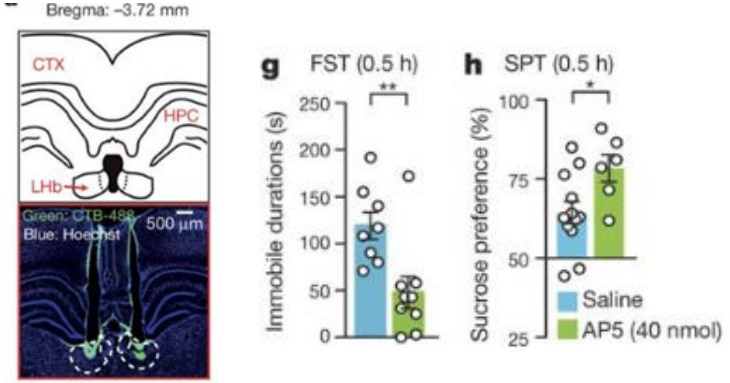

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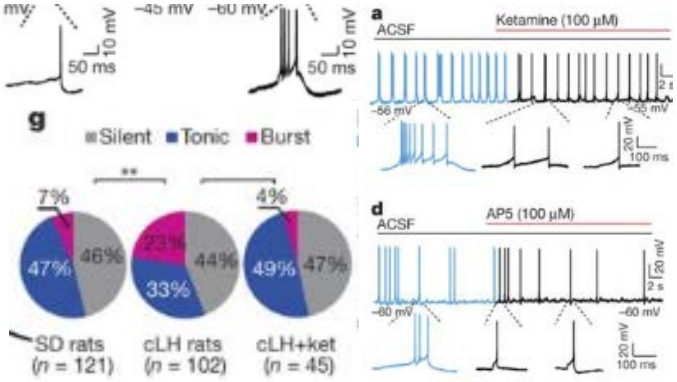
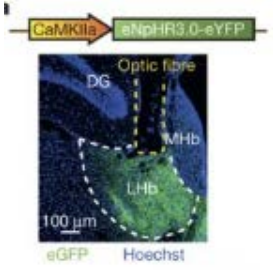
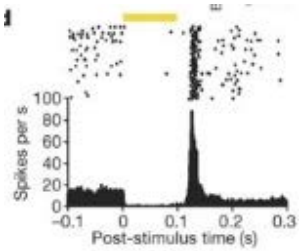
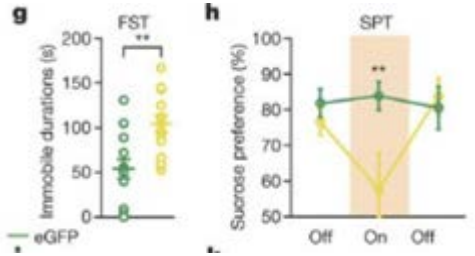


Figure 5: eNpHR3.0-induced rebound bursting drives behavioural aversion and depression-like symptoms that are reversible by ketamine.







Depressive behavior elicited by bursting

Hailan Hu lecture

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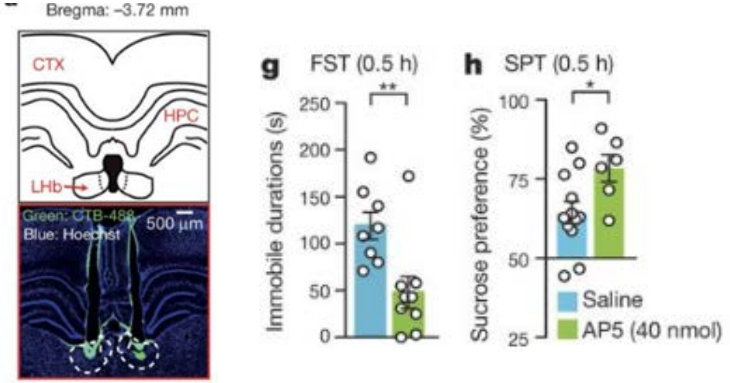

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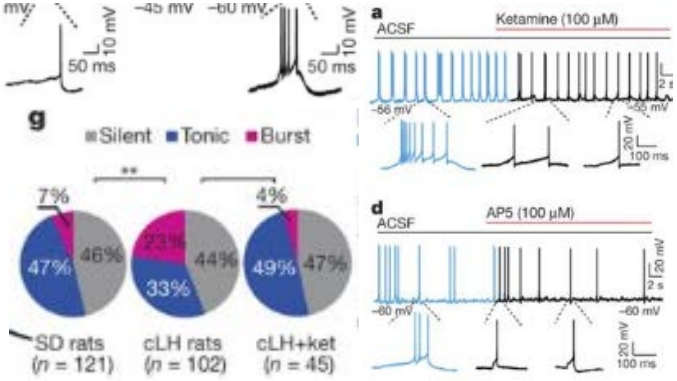

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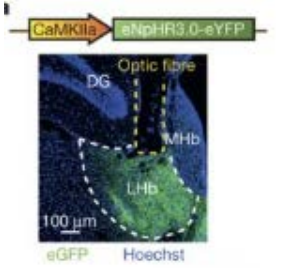

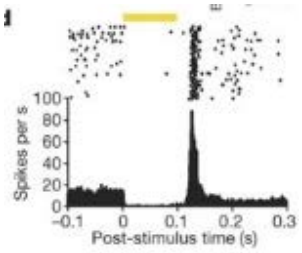

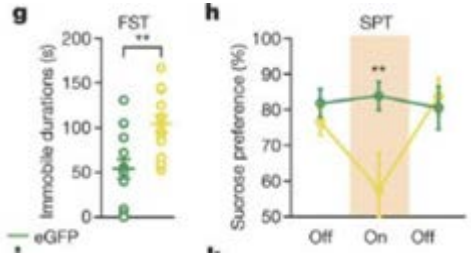

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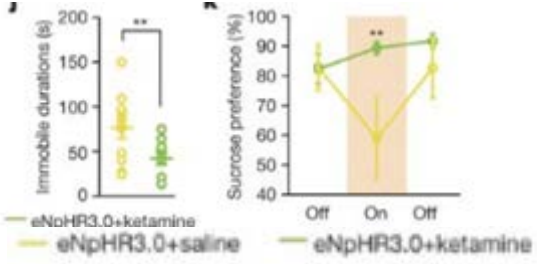

Hailan Hu lecture

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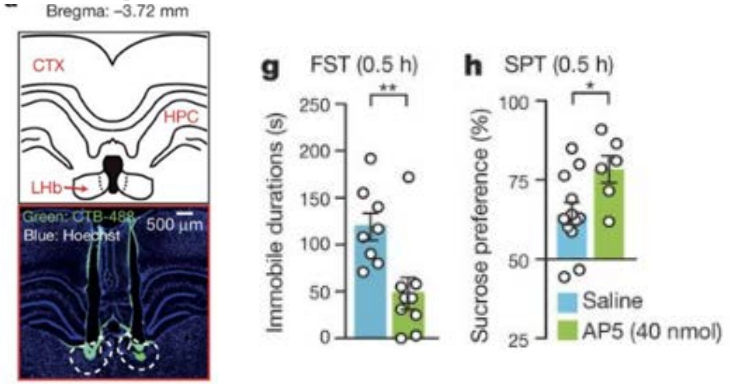

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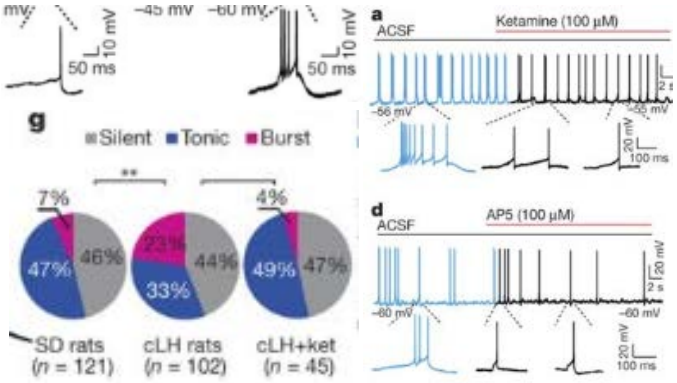

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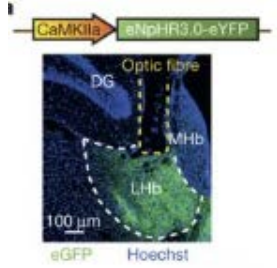

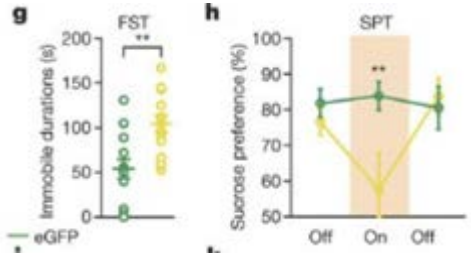

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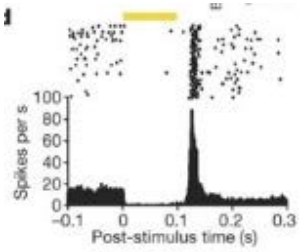
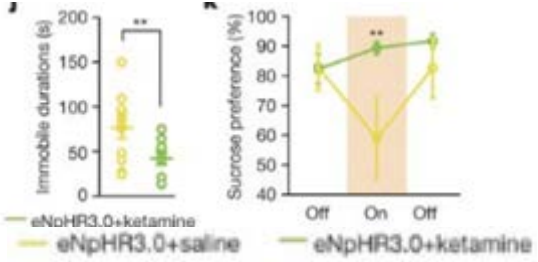




Ketamine blocks bursting in the lateral habenula to rapidly relieve depression

Yan Yang[1,2]*, Yihui Cui[1,2]*, Kangning Sang[1,2]*, Yiyan Dong[1]*, Zheyi Ni[1], Shuangshuang Ma[1] & Hailan Hu[1,2]

Astroglial Kir4.1 in the lateral habenula drives neuronal bursts in depression

Yihui Cui[1,2], Yan Yang[1,2], Zheyi Ni[1], Yiyan Dong[1], Guohong Cai[3], Alexandre Foncelle[4,5], Shuangshuang Ma[1], Kangning Sang[1], Siyang Tang[1], Yuezhou Li[1], Ying Shen[1], Hugues Berry[4,5], Shengxi Wu[3] & Hailan Hu[1,2]

USC Mark and Mary Stevens Neuroimaging and Informatics Institute

View Data With Schol-AR

Schol-AR: Augmented Reality for Scientific Publication & Communication

Tyler Ard, Arthur Toga
Data Provided by Sook-Lei Liew, Michael S. Bienkowski, Hong-Wei Dong, Lirong Yan

432.03

LONI
USC Laboratory of Neuro Imaging

Introduction

Nearly all neuroscientific research is based on digital technologies, however the cumbersome and underutilized nature of digital supplementary materials leaves the majority of neuroscientific communication constrained to the static figures and text of standard journal articles. Here we demonstrate an augmented reality (AR) solution which seamlessly integrates digital and printable media, ultimately facilitating the exchange of ideas and information.

Augmented Reality Layering

By 'attaching' various types of digital media to printable communications we avoid the inadequate simplification of complex information into 2D static figures, while retaining standard printable formats and all of their benefits.

Try it Yourself

The Schol-AR viewer is freely available for iOS and Android. Once opened, Schol-AR will prompt to download the appropriate augmentations, which can then be seen by simply viewing the figures on this poster through the app.

Android iOS
View Data With Schol-AR

1: Download

Download the app by aiming a smartphone camera at this QR and following the onscreen prompt. Or search Android/iOS stores for "Schol-AR" (including quotes).

2: View

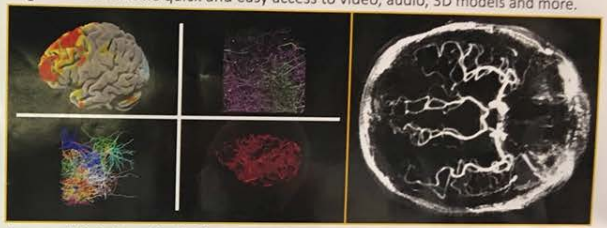
Every figure on this poster has accompanying digital augmentations that can be viewed through the Schol-AR application.

Soon we will open Schol-AR to everyone, enabling researchers around the globe to augment their scientific articles, posters, and other communications.

Contact DataVis@loni.usc.edu for inquiries and updates.

Improved Data Communication

Augmentation allows quick and easy access to video, audio, 3D models and more.



Layered digital media facilitates vastly improved portrayal and communication of a wide variety of data, concepts and ideas. In the figure above we demonstrate 3D and temporal data that is inadequately represented in print, but can be comprehensively explored and viewed through augmentation.

Schol-AR works on print, enabling access to digital materials without a computer. Additionally, for those who prefer electronic distributions Schol-AR works equally well on digital displays and does not require printed materials.

Supports Comprehensive Reporting

Commonly less than 5% of data is reported via 'representative images' due to the limitations of print. Augmentations such as this example provide easily accessible communication of full datasets, naturally addressing the issues stemming from this practice.

Discussion

We believe augmentation will dramatically improve our capacity to effectively exchange ideas and information, and are eager to see how the community utilizes these capabilities in novel and exciting ways.

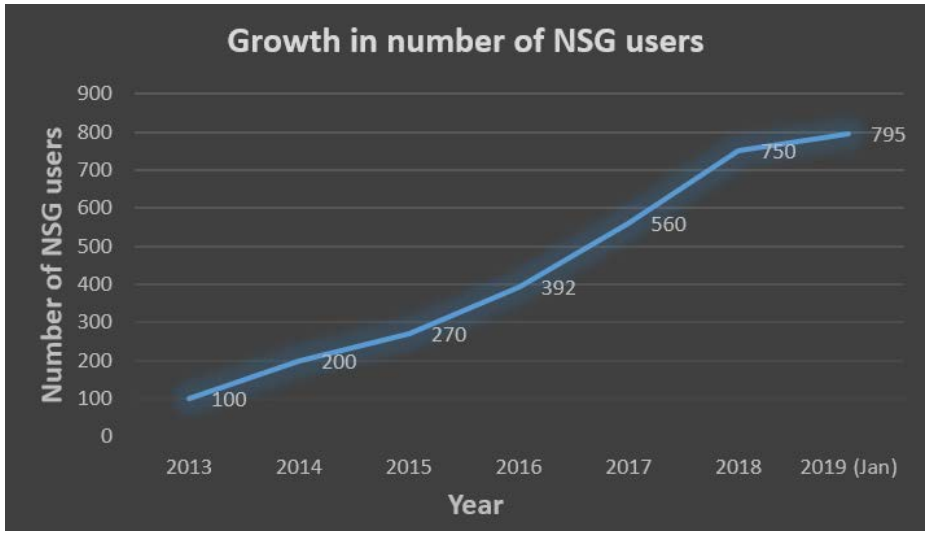
Contact: Tyler.Ard@loni.usc.edu

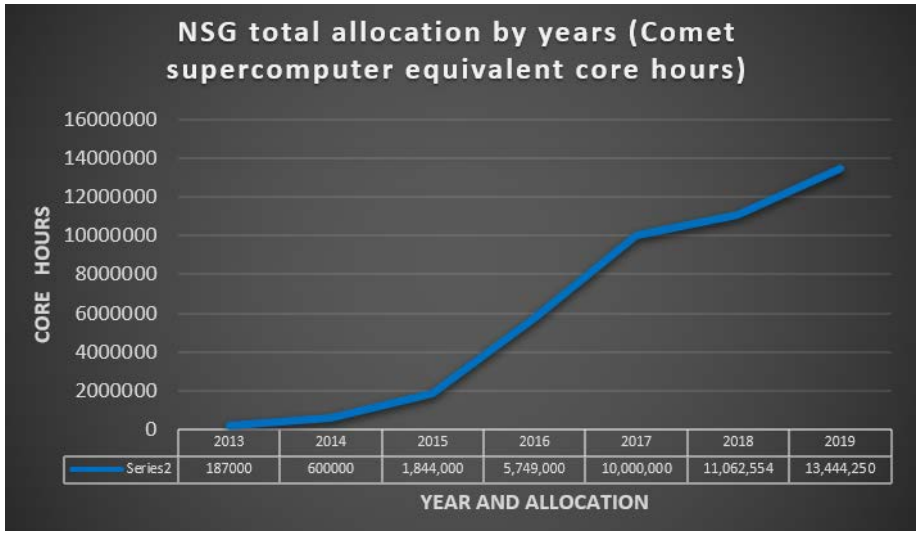
Presentation: 432.03, DD25

Neuroscience Gateway (Free HPC - NSF, UCSD, Yale, UCL)

By A. Majumdar

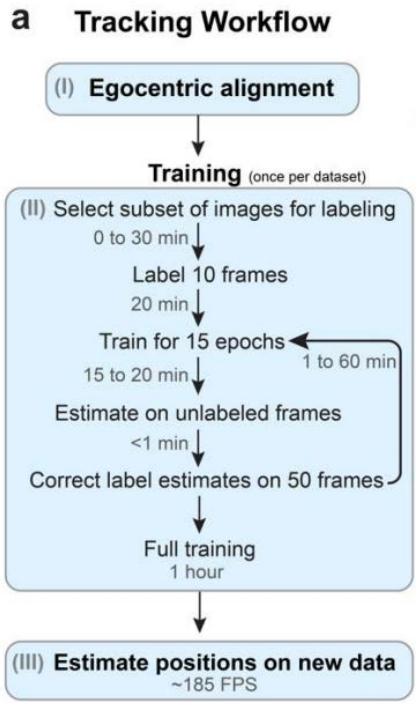
https://www.nsgportal.org

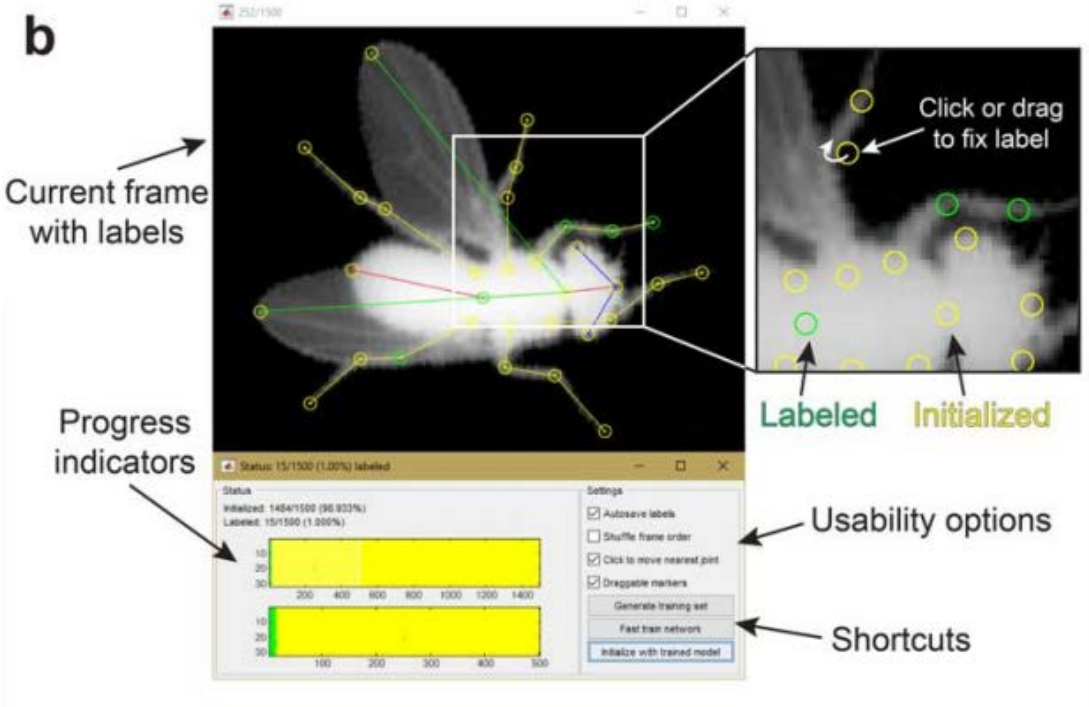

Growth in number of NSG users
Number of NSG users
900
800
700
600
500
400
300
200
100
0
100
200
270
392
560
750
795
2013
2014
2015
2016
2017
2018
2019 (Jan)
Year

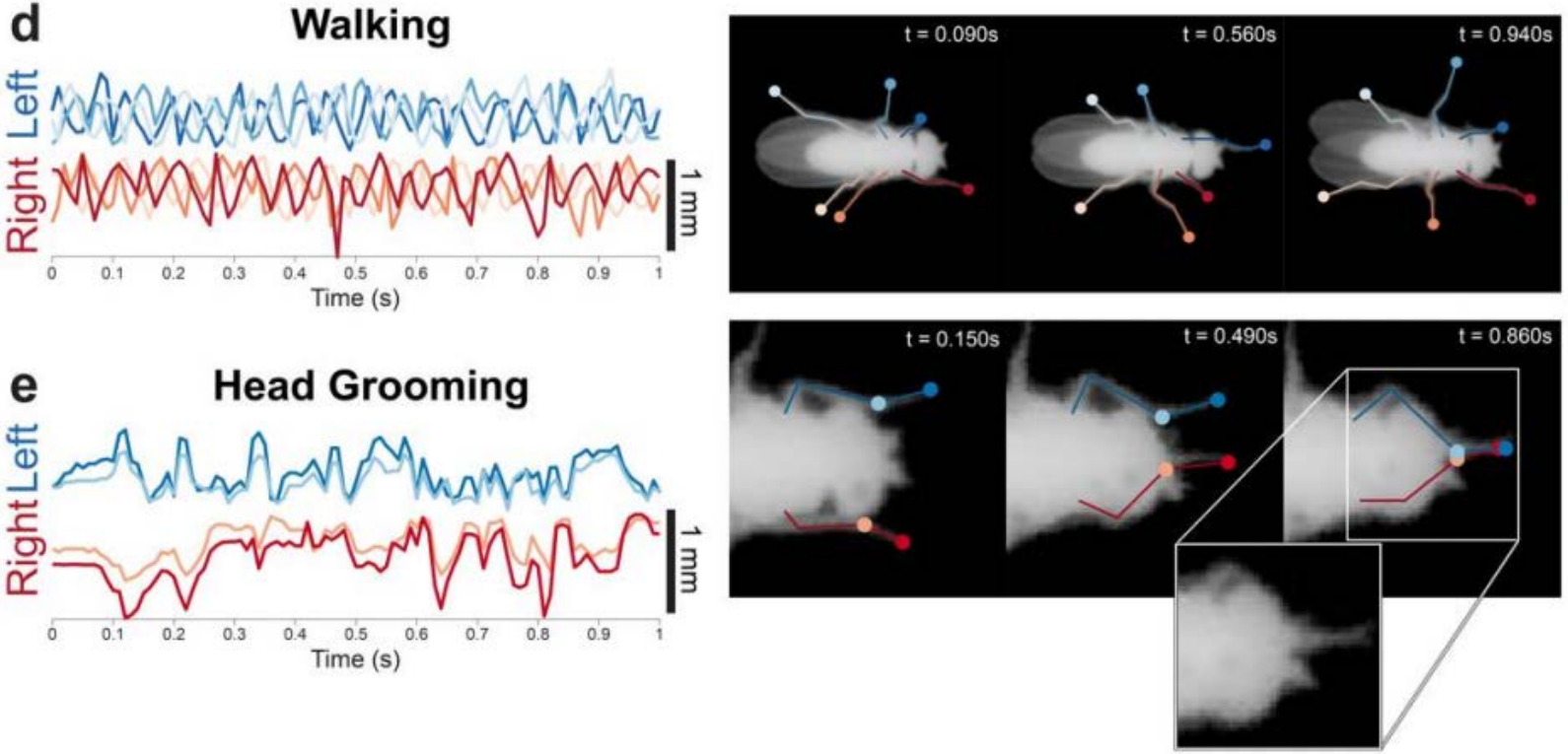

NSG total allocation by years (Comet supercomputer equivalent core hours)
CORE HOURS
16000000
14000000
12000000
10000000
8000000
6000000
4000000
2000000
0
2013
2014
2015
2016
2017
2018
2019
Series2
187000
600000
1,844,000
5,749,000
10,000,000
11,062,554
13,444,250
YEAR AND ALLOCATION

Multi-animal pose estimation using deep neural networks for social behaviors (LEAP - **L**EAP **E**stimates **A**nimal **P**ose)

-By Talmo Pereira






d
Walking
Left
Right
1 mm
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Time (s)
e
Head Grooming
Left
Right
1 mm
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Time (s)
t = 0.090s
t = 0.560s
t = 0.940s
t = 0.150s
t = 0.490s
t = 0.860s

Social LEAP

Features

- [ ] Tracking and alignment code
- [x] Cluster sampling GUI
- [x] Skeleton creation GUI (`create_skeleton`)
- [x] GUI for labeling new dataset (`label_joints`)
- [x] Network training through the labeling GUI
- [x] MATLAB (`predict_box.m`) and Python (`leap.predict_box`) interfaces for predicting on new data
- [ ] GUI for predicting on new data
- [x] Training data + labels for main fly dataset used in analyses
- [x] Trained network for predicting on main fly dataset
- [ ] Analysis/figure generation code
- [ ] Documentation
- [x] Examples of usage

Optical flow to characterize trajectory (to try to deal with identity swap)