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JULY 2021, ISSUE 1

# BRAIN CENTER NEWSLETTER

*The BRAIN Summer E-Newsletter*



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## Our Mission

The BRAIN Center will develop safe, effective and affordable personalized neurotechnologies for diagnostics, restoration, enhancement, and rehabilitation of sensory, motor, affective and cognitive functions. This mission will be pursued by supporting innovative interdisciplinary research across the multiple dimensions of brain function and behavior with the ultimate goal of improving quality of life.

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## Letter From the News Editors

Jenny Fula Torrijos & Sofia Alvarado - Newsletter Editors

During the past 7 weeks, our REU program has welcomed a total of 25 students and 2 guest High School (HS) students.

- 11 REU students from 9 universities
- 1 Post BS research trainees
- 3 Undergraduate trainees
- 10 High school trainees from 6 schools

It has been a whirlwind of delightful instruction, experimentation and new friendships since we began the program on May 24th. We are excited to see what comes next.

-Jenny Fula and Sofia Alvarado



Jenny Fula Torrijos



Sofia Alvarado

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# Our Scientists in Training

High School trainees



Akanksha Acharya  
Seven Lakes High School  
Mentor: David Eguren



Chloe Beaudreau  
Carnegie Vanguard High School  
Mentor: Alex Craik & Jose Gonzalez & Ayman Almir



Andres Contreras-Grassi  
Strake Jesuit  
Mentor: Alexander Steele



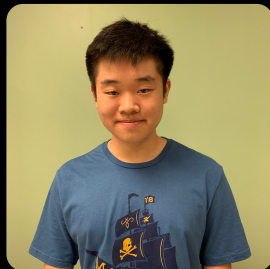
Kartikeya Gullapalli  
Carnegie Vanguard High School  
Mentor: Akshay Ravindran



Isabel Khattar Hatem  
Carnegie Vanguard High School  
Mentor: Akshay Ravindran



Andrew Sazykin  
Bellaire High School  
Mentor: Alexander Steele



Allen Shen  
Clear Lake High School  
Mentor: Alexander Steele



Adhithi Venkatraghavan  
Seven Lakes High School  
Mentor: Akshay Ravindran



Dhivya Venkatraghavan  
Seven Lakes High School  
Mentor: Akshay Ravindran



Leo Zou  
Dulles High School  
Mentor: David Eguren

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Students attending the REU program



Sofia Alvarado  
University of Houston  
Mentor: Jenny Fula Torrijos



Anthony Bulthuis  
NC State University  
Mentor: Akshay Ravindran



Luca Cohen  
Colorado School of Mines  
Mentors: Samuel Montero & Akshay Ravindran



Prithwiraj Choudry  
University of Houston  
Mentor: Runjia Li & Vishal Talari



David Equilang  
University of Houston  
Mentor: Alex Craik



Kennedy Leonard  
John Hopkins University  
Mentor: Nishant Rao



Michael Ly  
Stony Brook University  
Mentor: Samiul Alam



Bryan Melgar  
University of Houston  
Mentor: Chris Malaya



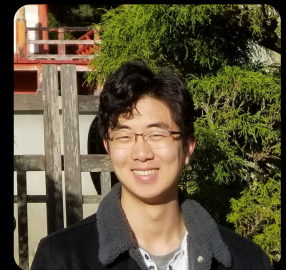
Ava Nelson  
University of Houston  
Mentor: Akshay Ravindran



Ai Nguyen  
University of Houston  
Mentor: Runjia Li & Tian Tong



Jocelyn Ramos  
University of Houston  
Mentor: Yitong Lu & Dr. Julien Leclerc



Chae Park  
Pomona College  
Mentor: Runjia Li & Tian Tong



Muhammad Rafaqut  
UT- Rio Grande Valley  
Mentor: Samiul Alam



Carolina Ramirez  
Texas A&M University  
Mentors: Alex Craik, Jose Gonzalez & Ayman Alamir



Jacob Tajchman  
University Of Massachusetts  
Mentors: Alex Craik, Jose Gonzalez & Ayman Alamir

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Honors Student



Krishna Sarvani  
Desbathola  
University of Houston

REU CARTA/IUCRC BRAIN Training Program



Adriana Lopez Cajigas  
University of Houston



Nhat Nguyen  
University of Houston

REU Graduate Mentors



Ayman Alamir



Rafiul Amin



Alex Craik



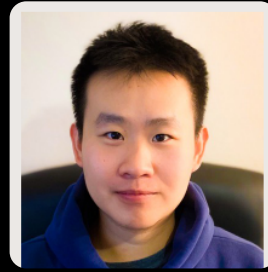
David Eguren



Jose Gonzales



Julien Leclerc



Runjia Li



Yitong Lu



Chris Malaya



Samuel Montero



Andrew Paek



Nishant Rao



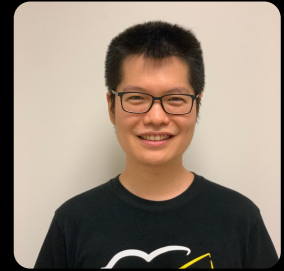
Akshay Ravindran



Alexander Steele



Vishal Talari



Tian Tong

## Our Faculty

Faculty involved with BRAIN Summer 2021



Dr. Jiming Bao

Department of Electrical & Computer Engineering



Dr. Aaron Becker

Department of Electrical & Computer Engineering



Dr. Jose Contreras-Vidal

Department of Electrical & Computer Engineering



Dr. Rose Faghieh

Department of Electrical & Computer Engineering



**Dr. Jeff Feng**  
Department of Industrial  
Design



**Dr. Charles Layne**  
Department of Health and  
Human Performance



**Dr. Dong Liu**  
Department of Mechanical  
Engineering



**Dr. David Mayerich**  
Department of Electrical &  
Computer Engineering



**Dr. Pranav Parikh**  
Department of Health and  
Human Performance



**Dr. Luca Pollonini**  
Department of Engineering  
Technology

## Faculty Spotlight

**Dr. Aaron Becker**

**What field of study do you participate in?**

Robotics! I love robots of all sizes, shapes, and abilities, especially in large numbers

**How long have you been working with BRAIN and why?**

Three years. BRAIN is bringing together a vibrant community of experts, and it is wonderful to share ideas

**What is some advice you would like to give to the REU students?**

Read at least one research paper a week. Write a little every day – writing is hard, so just do it

**What is one goal you have for this summer?**

Win the research quiz we have at the start of our weekly lab meetings, learn how generate and combine geometry regions using the programming language Python, finish my German Duolingo language tree.



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# Mentor Spotlight

Akshay Ravindran

## Why did you choose to work with BRAIN?

"... I believe the BRAIN is a great opportunity to connect with people with different specializations fostering collaborations. For e.g. in my funded project, our lab collaborates with Dr. Gerard E. Francisco at TIRR Memorial Hermann and Dr. Charles Layne at Health and Human Performance (HHP). Entering the second phase of the project we are now expanding the collaboration with Dr. Pranav Parikh at HHP. BRAIN provides an opportunity to pool the expertise and resource to improve our research capabilities...The possibility to collaborate is what really excites me to work with the BRAIN."

## What is your particular interest/project?

"My goal is to help develop better and robust non-invasive brain-machine interface systems using EEG by emphasizing on the interpretability and explainability of deep learning-based decoders..."

## What general advice would you give your students?

"Early in your career, I recommend that they expose and explore quite varying areas of research so that you can take an informed and driven career choice. Passion is critical in life as it makes the journey fun, but realize that your passion is also limited to things you are exposed to. So it is ok for it to evolve with time. Explore many things early in your career & let your passion drive the journey. Also, communication is very important, if we have challenges, roadblocks, agreements, or disagreements they should communicate them early and often..."

## What is one goal you have for this summer?

I would like to provide high-level exposure to various elements of research to all the trainees and also help them identify their aspirations so that they can advance their careers in that direction. On my personal research, I plan to complete the first chapter of my dissertation research.



# Art-Science-AI Performance

On Friday June 11th, 2021, the BRAIN center came together to present the Nahual project. This program has been occurring since 2019. The Artist-in-Residence Geraldina Interiano Wise, was fitted with a headset to record her brain activity while she paints. Her brain waves and artistic output are used to train an AI program that learns from her actions and responds to the creativity by generating a digital painting co-existing with the physical canvas. On Friday, we had the pleasure of experiencing one of these performances and as she made aesthetic decisions the AI program also synthesized sound bites based on her internal states represented in her brain activity. It was an amazing moment between the arts and sciences. Her work, which was done on a piece of yute cloth, was an incredible combination of colors that speak to her culture and feelings. This experience was one of a kind and worth seeing again. Stay tuned!



## Yoga on the Brain

The Yoga on the Brain was one of many modules offered as part of a course (NeuroHumanities: Convergent research at the nexus of neuroengineering and the humanities; Course: ECE 5397/6397) where Dr. Jose Contreras-Vidal was the instructor and Akshay Ravindran was the teaching assistant.

"The neurohumanities is an emergent field of study and research that brings together humanists (from the arts, language, ethics, philosophy, social science, and culture) and neuro engineers into dialogue to address some of the most pressing issues in society. This course reviewed approaches, methodologies, and neurotechnologies that can be used to pursue convergent research in the neurohumanities. This course was aimed at students from all areas of humanities and engineering."

One of the modules was the workshop Yoga, Meditation, and the Brain. These workshops were a collaboration with Andrew Royal Dugas, Andria Dugas, and Lizzy Bosell of Yoga Better Studio, in order to study the effects of yoga on brain activity. It lasted a total of 4 days at The Water Works at Sabine Street. Participants were trained on how to acquire their own brain activity. Then received training on different yogic postures during which each participant collected their brain activity.



# Mediated Research Projects offered by the IUCRC BRAIN Center faculty:

## **Biomedical applications and simulations of photoacoustic laser streaming**

*Jiming Bao*

*Professor, Department of Electrical and Computer Engineering*

Description: COMSOL simulation of photoacoustics, exploration of biomedical application of photoacoustic laser streaming

## **Improving capabilities and performance of magnetic milli-scale swimmers**

### **swimmers**

*Aaron Becker*

*Assistant Professor, Department of Electrical and Computer Engineering*

Description: Designing, building, and testing magnetic milli-scale swimmers for clot abrasion and targeted drug therapy

## **Art-Science-AI: Neural Basis of Creativity: Nahual**

*Jose L. Contreras-Vidal*

*Fellow IEEE, Cullen Professor, Director/PI, NSF IUCRC BRAIN*

Description: Artificial Intelligence (AI) and Brain-Computer Interface (BCI) driven interactive art: neural dynamics style transfer in real-time

## **Neurorex: BMI-Walking Exoskeleton**

*Jose L. Contreras-Vidal*

*Fellow IEEE, Cullen Professor, Director/PI, NSF IUCRC BRAIN*

Description: Localized EEG sources during BMI control of a walking exoskeleton

## **Euroexo**

*Jose L. Contreras-Vidal,*

*Fellow IEEE, Cullen Professor, Director/PI, NSF IUCRC BRAIN*

Description: NeuroExo: A brain-computer interface for stroke rehabilitation

## **Pediatric Exoskeleton**

*Jose L. Contreras-Vidal*

*Fellow IEEE, Cullen Professor, Director/PI, NSF IUCRC BRAIN*

Embedded systems development

Description: Custom brace 3D scanning, 3D printing and durability testing

## **Wearable Machine Interface Architectures**

*Rose T. Faghhi*

*Assistant Professor, Director, Computational Medicine Laboratory Assistant*

*Professor, Department of Electrical and Computer Engineering*

Description: Towards Enhancing Human Performance: Electrodermal Activity and Human Performance Under Cognitive Stress

# Mediated Research Projects offered by the IUCRC BRAIN Center faculty:

**Design of Mobile brain-body imaging (MoBI) technology for**

## **Rapid Recording**

*Jeff Feng*

*Associate Professor, Gerald D. Hines College of Architecture & Design*

Description: A Headset Research and Development to Integrate Eye-tracking and EEG Scan into One Hardware.

**EEG detection of balance loss, a novel approach to prevent falls implementing**

## **Robotic Orthosis**

*Charles Layne*

*Professor, Department of Health and Human Performance*

*College of Liberal Arts and Social Sciences*

Description: Identifying EEG during posture perturbations for use in activating powered exoskeletons to prevent falling in patient populations.

**Enabling Light-Driven Microfluidics with Laser Streaming**

*Dong Liu*

*Professor Department of Mechanical Engineering*

Description: Numerical simulation of the multiphysics processes involved in laser streaming

**Cortical Control of Balance in Stroke**

*Pranav Parikh*

*Assistant Professor, Department of Health and Human Performance College of Liberal Arts and Social Sciences*

Description: Analysis of balance data obtained on stroke patients and understanding them in relation to task difficulty.

**Evoked Response Potentials on End-Of-Life**

## **Patients**

*Luca Pollonini*

*Assistant Professor, Director, Optical Bioimaging Lab ,Co-PI, NSF IUCRC BRAIN,*

*Department of Engineering Technology, Department of Electrical and Computer Engineering*

Description: Analysis of preliminary EEG/ERP data collected on dying patients and non-dying control cohorts in response to auditory stimuli (artificial and speech sounds).