

Brain activity analysis

- We have the brain activity data for restricted amount of epileptic patients in 5 different classes (lobe focus).
- The task is to build a classifier using different methods (Like Neural Networks)
- For the observed patients in class C1 and C2 we have

$[a, b]$ = smallest interval containing all the activities for patients in C_1
 $[c, d]$ = smallest interval containing all the activities for patients in C_2

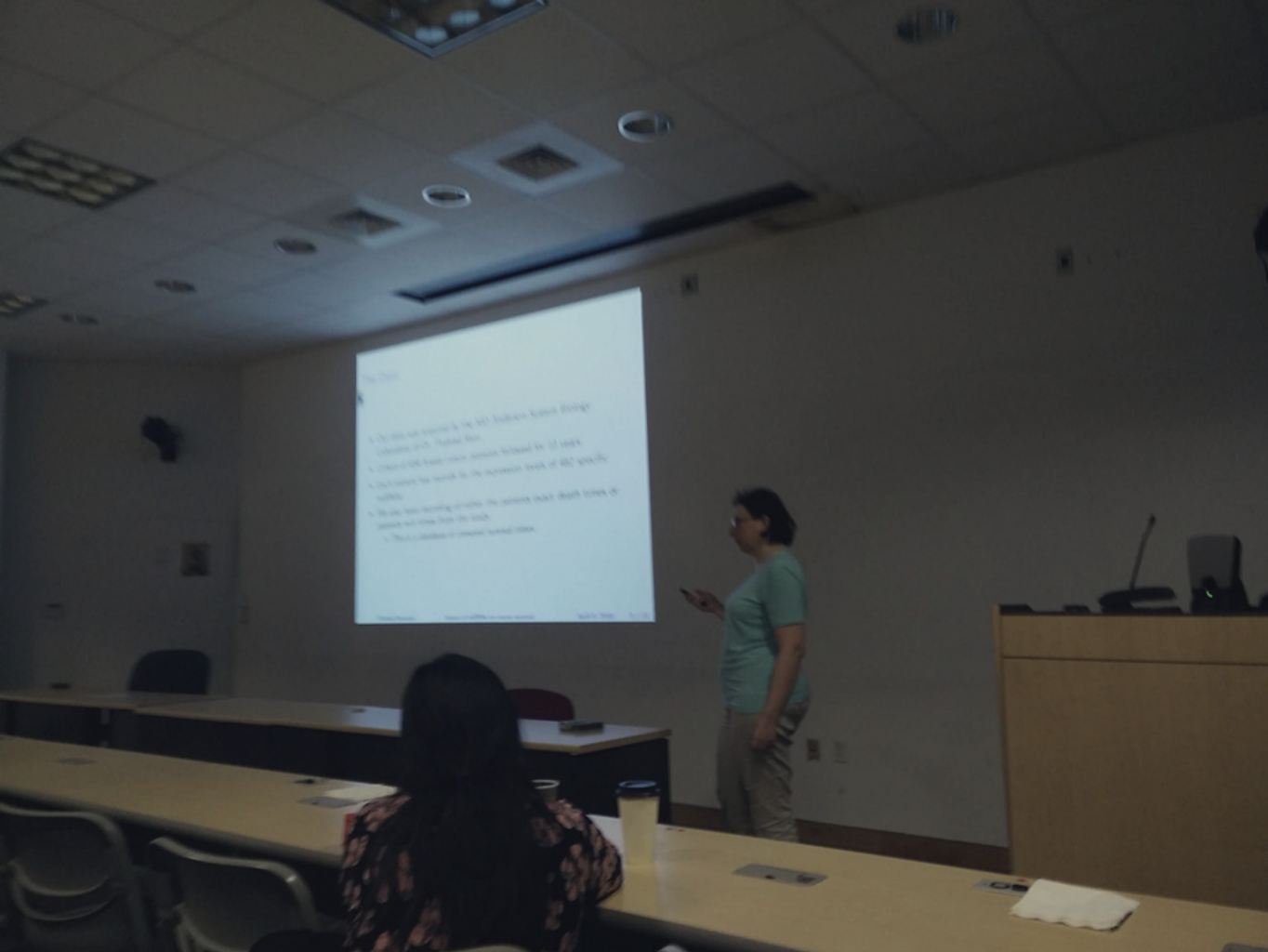
- We need to identify the regions that corresponding activity for patients in class C1 is different from the activity for patients in C2 i.e. find disjoint intervals. Lets define a measure:

$$\text{discr}(REG) = 1 - \max \left\{ \frac{\text{size}([a, b] \cap [c, d])}{\text{size}([a, b])} ; \frac{\text{size}([a, b] \cap [c, d])}{\text{size}([c, d])} \right\}$$



German Tank
Estimation and its
application in the
classification
problem

Rasoul Hekmati



Impact of miRNA on cancer survival

**Viktoriya
Muravina**

Outline Introduction Coupling Energy Inequality References

Navier-Stokes equations

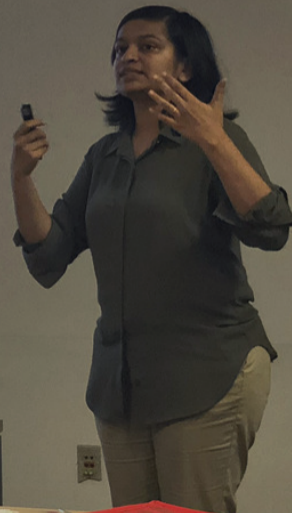
How to model blood flow in medium to large arteries?

Let's use a simplified, 2D model to understand.
Conservation of mass and momentum helps derive
Navier Stokes equations for incompressible, viscous fluids.

$$\rho \left(\frac{\partial \mathbf{u}}{\partial t} + (\mathbf{u} \cdot \nabla) \mathbf{u} \right) = \nabla \cdot \boldsymbol{\sigma}(\mathbf{u}, \rho) \quad \text{on } \Omega(t)$$
$$\nabla \cdot \mathbf{u} = 0 \quad \text{on } \Omega(t)$$

\mathbf{u} =velocity, ρ =density, $\boldsymbol{\sigma}(\mathbf{u}, \rho)$ = Cauchy stress tensor

Blood Flow Through Arteries



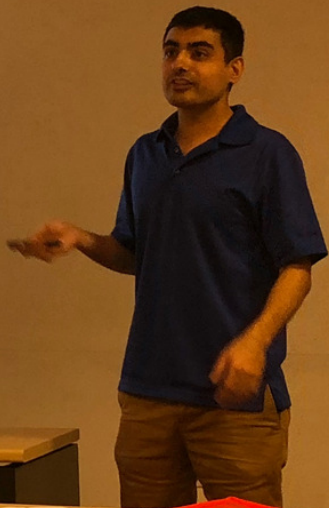
Blood flow through arteries: Fluid-Structure Interaction approach

Prajakta Bedekar

MNIST: A dataset of handwritten digits

0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9

Kazem Safari MNIST Occlusion April 6, 2018 3 / 17



Partial occlusion effects on AlexNet

Kazem Safari

New Example

Theorem (Kalantar, Kennedy, Breuillard, Ozawa)

Suppose that Γ is a discrete group and N is a normal subgroup of Γ . Then Γ is C^* -simple iff N and $C_\Gamma(N)$ are C^* -simple.

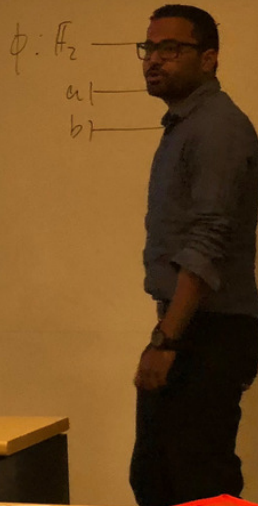
Example (Tattwamasi)

Let $\phi: \mathbb{F}_2 \rightarrow \mathbb{Z}$ be a group homomorphism defined by sending $a \rightarrow 1$ and $b \rightarrow 0$.

- $\ker \phi$ is normal in \mathbb{F}_2
- $C_{\mathbb{F}_2}(\ker \phi) = \{e\}$
- (Powers) \mathbb{F}_2 is C^* -simple
- $\ker \phi$ is C^* -simple.
- $\mathbb{F}_2 / \ker \phi$ is isomorphic to \mathbb{Z} as groups

Action of the free group on its boundary

Tattwamasi Amrutam



Quasi-static Dynamical Systems

Duong Nguyen

Navigation
Quasi-static Dynamical Systems
Navigation
Further Work

Further Explanation

Triangular array $\mathcal{T} = \{T_{n,k} \in M, 0 \leq k \leq n-1\}$, and $\gamma: [0,1] \rightarrow M$ satisfies:

$$\lim_{n \rightarrow \infty} T_{n, \lfloor nt \rfloor} = \gamma(t)$$

• \mathcal{T} describes the dynamics.

Duong Nguyen | Quasi-static Dynamical Systems



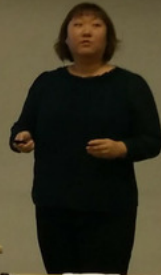
A kinetic theory approach to pedestrian motion

Daewa Kim

The numerical method: Lie Scheme

Given $f^i(t^i, x)$, for $i = 1, \dots, 3$.

1. Find f^i such that
$$\begin{cases} \frac{\partial f^i}{\partial t} + \frac{\partial}{\partial x} ((v[\rho] \cos \theta_i) f^i(t, x)) = 0 & \text{on } (t^i, t^{i+1}) \\ f^i(t^i, x) = f^{i-1} \end{cases}$$
Set $f^{i+1/2} = f^i(t^{i+1}, x)$.
2. Find f^i such that
$$\begin{cases} \frac{\partial f^i}{\partial t} + \frac{\partial}{\partial y} ((v[\rho] \sin \theta_i) f^i(t, x)) = 0 & \text{on } (t^i, t^{i+1}) \\ f^i(t^i, x) = f^{i-1/2} \end{cases}$$
Set $f^{i+1} = f^i(t^{i+1}, x)$.
3. Find f^i such that
$$\begin{cases} \frac{\partial f^i}{\partial t} = \mathcal{J}[f^i](t, x) & \text{on } (t^i, t^{i+1}) \\ f^i(t^i, x) = f^{i+1} \end{cases}$$
Set $f^{i+1} = f^i(t^{i+1}, x)$.



Well-posedness for weak solutions of axisymmetric div-curl systems

Juan Lopez

Basic problem

- Let $\Omega_A \subset \mathbb{R}^3$ be a smooth bounded volume of revolution about the z -axis with cross-section Ω . The problem is an axisymmetric div-curl system to find a vector field $\mathbf{u}: \Omega_A \rightarrow \mathbb{R}^3$ satisfying

$$\operatorname{div}(\mathbf{u}) = g \quad \text{in } \Omega_A,$$

$$\operatorname{curl}(\mathbf{u}) = \omega \quad \text{in } \Omega_A,$$

where $g = g(r, z)$, $\omega = \omega(r, z)$, $\operatorname{div}(\mathbf{u}), \operatorname{curl}(\mathbf{u})$ given in cylindrical coordinates:

$$\operatorname{div}(\mathbf{u}) = \frac{1}{r} \frac{\partial(r u_r)}{\partial r} + \frac{\partial u_z}{\partial z}$$

$$\operatorname{curl}(\mathbf{u}) = -\frac{\partial u_\theta}{\partial z} \mathbf{e}_\theta + \left(\frac{\partial u_z}{\partial z} - \frac{\partial u_\theta}{\partial r} \right) \mathbf{e}_r + \frac{1}{r} \frac{\partial(r u_\theta)}{\partial r} \mathbf{e}_z.$$

u_r, u_θ, u_z are the cylindrical components of \mathbf{u} .

One-Bit Phase Retrieval

Dylan Domel-White

Reconstruction from One-Bit Measurements

Approximate Reconstruction - Phaseless

Let $x \in \mathbb{R}^n$, $\lambda > 0$, $m \geq C \log(n)/\lambda^2$ and $\{y_i\}_{i=1}^m$ be independently uniformly distributed rank- α positive semidefinite matrices. Let \tilde{x} be a principal unit eigenvector of $Q_\lambda(x)$. Then with probability at least $1 - \exp(-Dm/\alpha)$ we have

$$\|x - \tilde{x}\|_2 \leq \lambda$$

where C and D are constants independent of m, n , and λ .

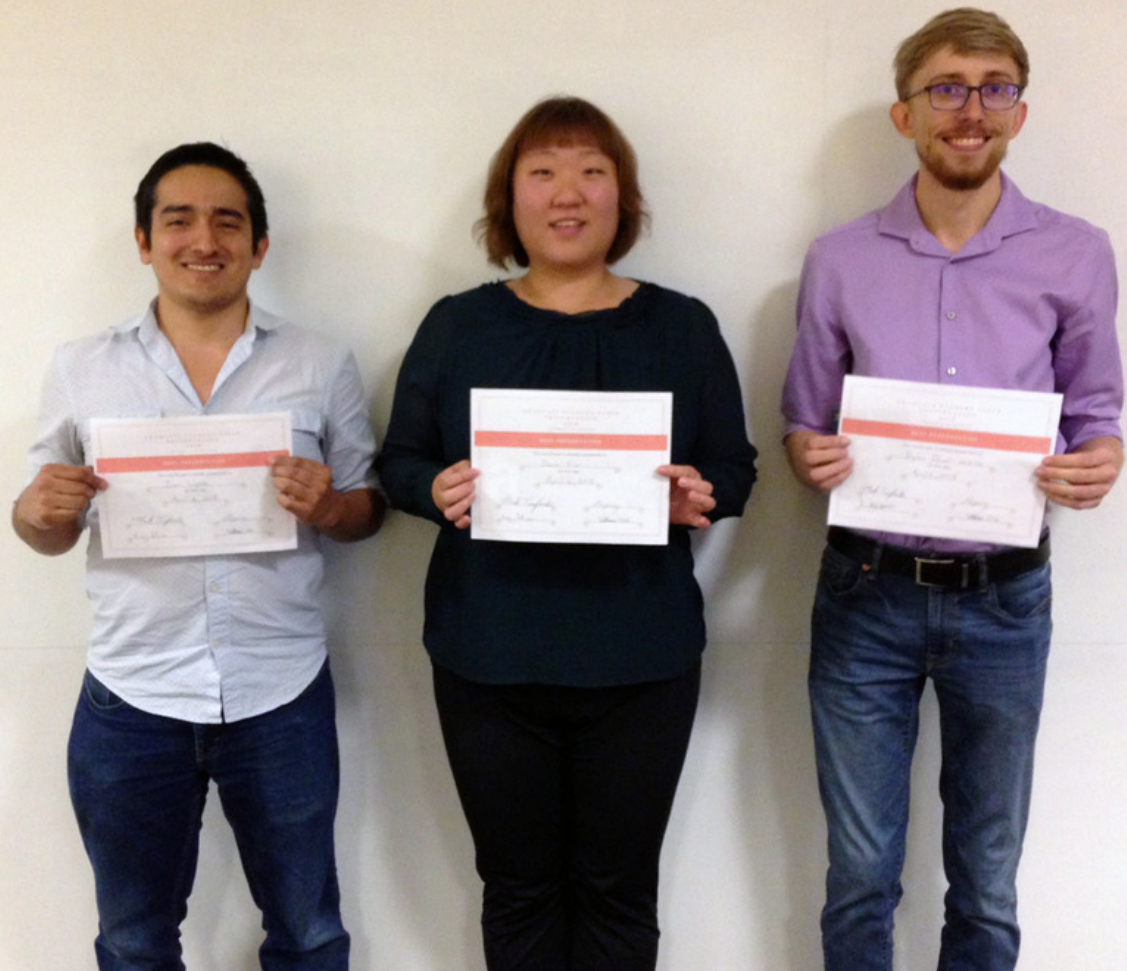
Note: $\|x - \tilde{x}\|_2 = \|x\|_2 \sin(\theta)$, where θ is the principal angle between the subspaces $\text{span}\{x\}$ and $\text{span}\{\tilde{x}\}$.

© 2014 Dylan Domel-White, MIT. All rights reserved. April 10, 2014 17 / 28





Audience



**Winners
(L to R)
Juan, Daewa
and Dylan**



Winners and Judges



Presenters and
Judges



Everybody