PANEL

INCREMENTAL LEARNING:
HOW SYSTEMS CAN AUTOMATICALLY ADAPT TO AND LEARN FROM NEW SITUATIONS

moderator: Els Lefever

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language and translation technology team

INCREMENTAL LEARNING

- Incremental learning = a “machine learning paradigm where the learning process takes place whenever new example(s) emerge and adjusts what has been learned according to the new example(s)” (Geng & Smith-Miles, 2015)

  - Traditional machine leaning: implicit assumption that a “good” training set in a domain is available a priori => the training set contains all necessary knowledge that once learned, can be reliably applied to any new examples in the domain

  - In practice: many real-world applications cannot match this ideal case

PANELISTS

- Nuri Ince, University of Houston, USA:
"Closed Loop Deep Brain Stimulation in Movement Disorders"

- Pengyu Hong, Brandeis University, USA:
"Using artificial neural networks to analyze biological neurons via transfer learning"

- Elena Ravve, Ort Braude College, Israel:
"Incremental reasoning on strongly distributed systems"

- Els Lefever (moderator), Ghent University, Belgium:
"domain/context-specific and implicit sentiment analysis"

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ELENA RAVVE

ORT BRAUDE COLLEGE, ISRAEL

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ELENA RAVVE: INCREMENTAL LEARNING

Given:

- a distributed system.
- a (quantitative) learning property.

The question is:

Does a set of effectively algorithmically derived properties exist such that:

1. *each such a property can be evaluated locally;*
2. *from the local answers, and possibly some additional information, we compute the result for the given global property?*

Such a set of derived properties is called **reduction sequence**.

INCREMENTAL LEARNING: LOGICAL TOOLS

Given:

- a strongly distributed system $\mathcal{A}$ that is composed from structures $\mathcal{A}_i$ $(i \in I)$ and index structure $\mathcal{I}$.
- A formula ϕ of logic $\mathcal{L}$ describes the learning on $\mathcal{A}$.

The question is:

What is the reduction sequence for ϕ?

The answer is:

The corresponding reduction sequence for $\mathcal{A}$ can be effectively computed algorithmically in many cases.

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PENGYU HONG

BRANDEIS UNIVERSITY, USA

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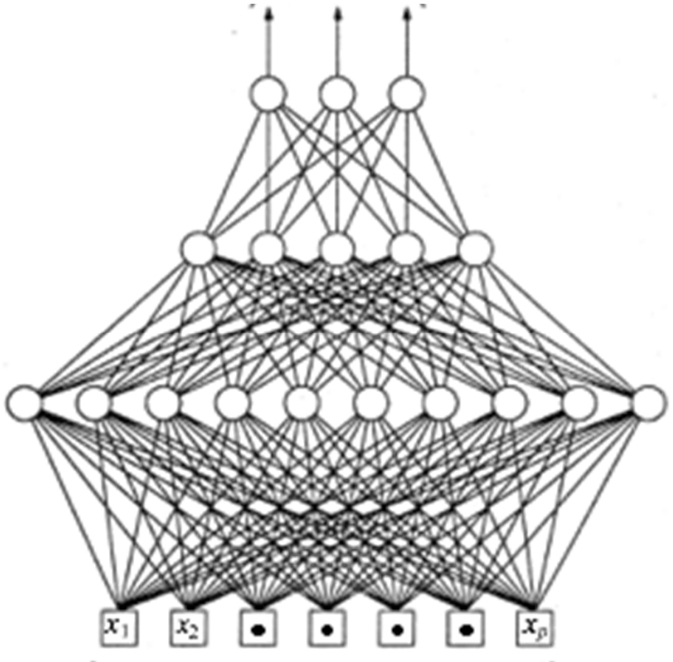
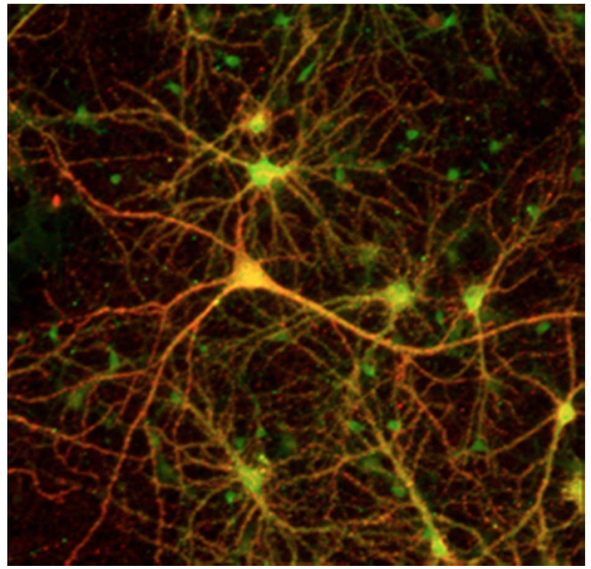
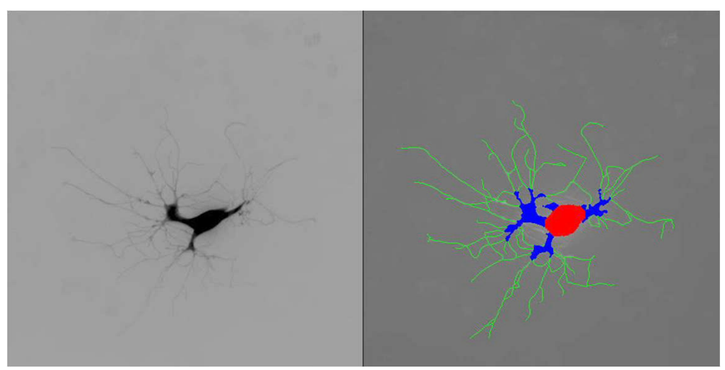
PENGYU HONG: TRANSFER LEARNING



Learning



Task: Train Artificial Neural Networks to Analyze Artificial Neural Networks



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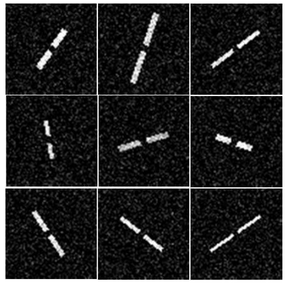
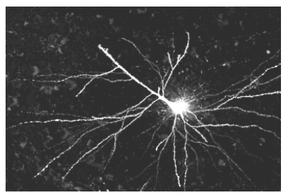
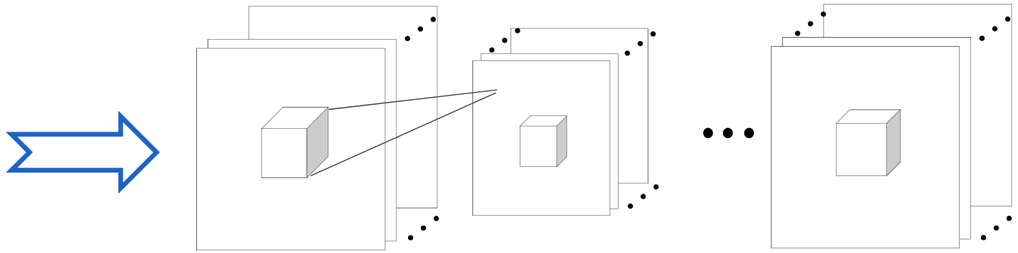
EFFECTIVE LEARNING

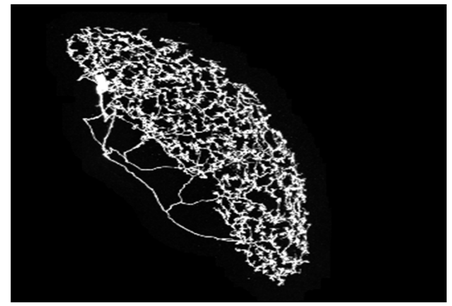


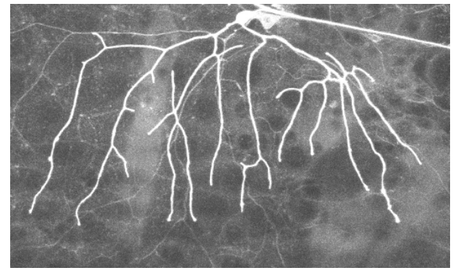


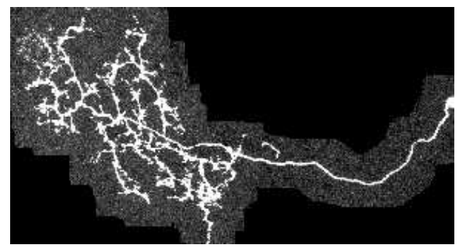
Deep Learning from Large Amount of Synthetic Data and
Small Amount of Labeled Real Data



Apply to







Learn from “Toy” Examples and Generalize to Real Scenarios

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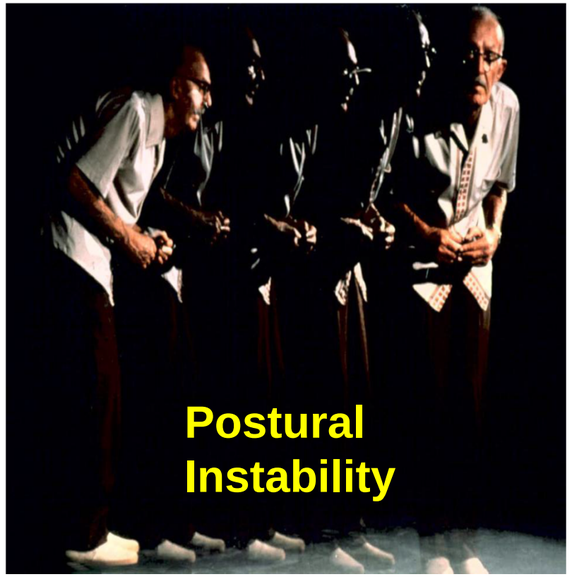
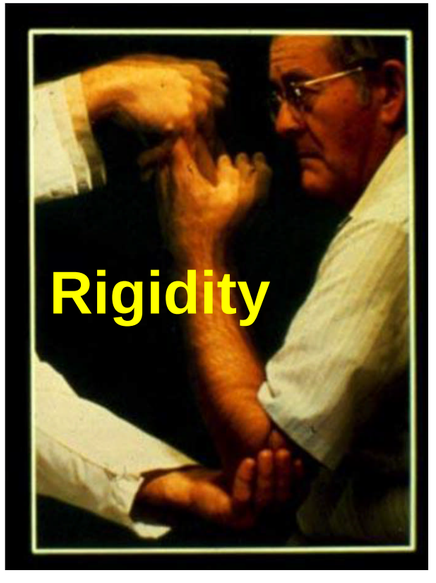
Functional Use Of Local Field Potentials for the Personalization of DBS in Parkinson's Disease

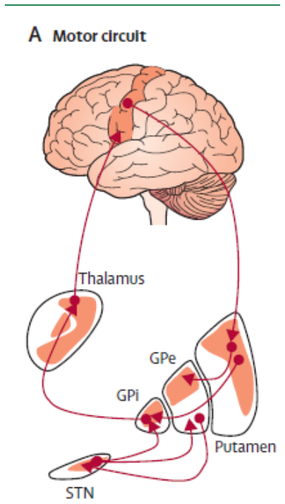
Nuri F. Ince, Ph.D.
Clinical Neural Engineering Laboratory (CNELab)
Department of Biomedical Engineering, University of Houston

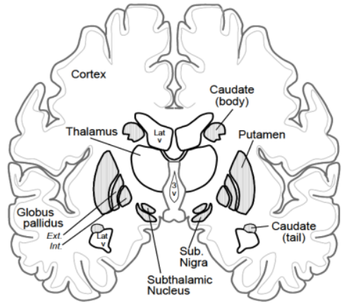


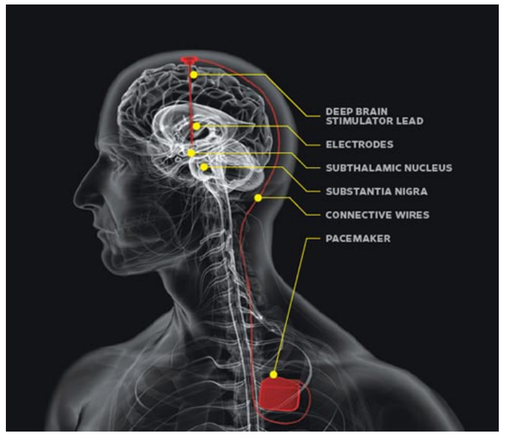


PARKINSON’S DISEASE

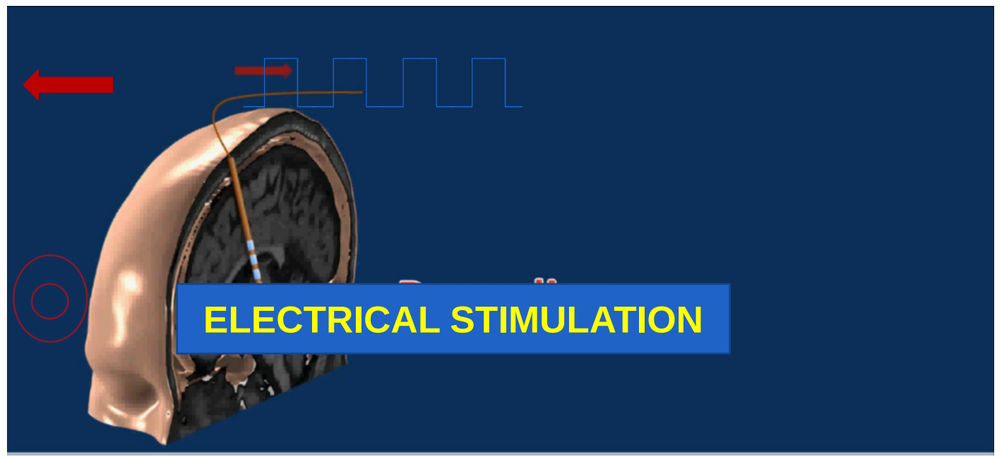
- Parkinson's disease (PD) was first described in 1817 by James Parkinson as a particular form of progressive motor disability (Samii, Nutt, & Ransom, 2004).
- PD is a chronic and progressive movement disorder, meaning that symptoms continue and worsen over time.
- Today, PD is the second most common neurodegenerative disorder after Alzheimer’s dementia.
- Nearly one million people in the US are living with PD.







- Although there is presently no cure, there are treatment options such as medication and DBS to manage its symptoms.
- DBS very effective but
- Stim side effects
- Open Loop
- Does not adapt fluctuating symptoms
- Battery runs out in 3-5 years



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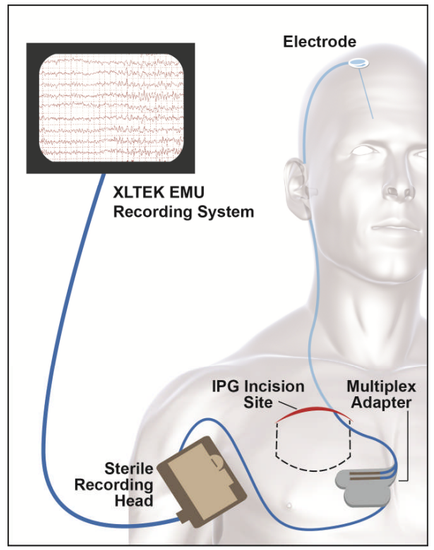
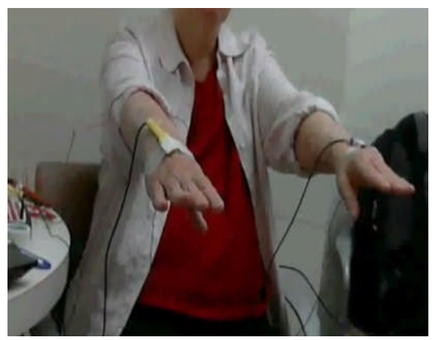
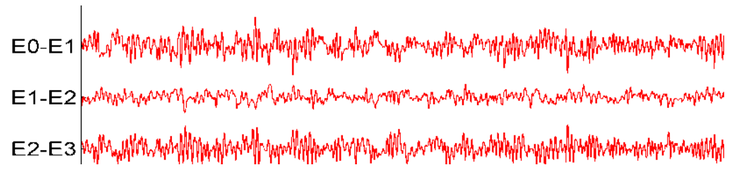
BIDIRECTIONAL INTERFACE

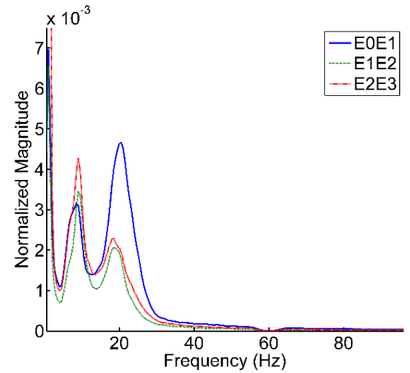




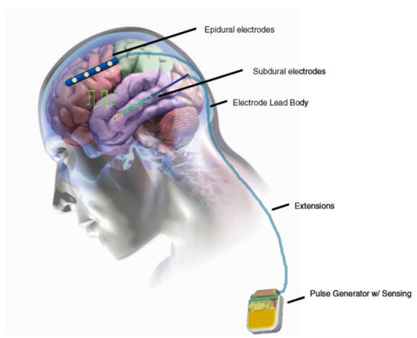
Local Field Potentials



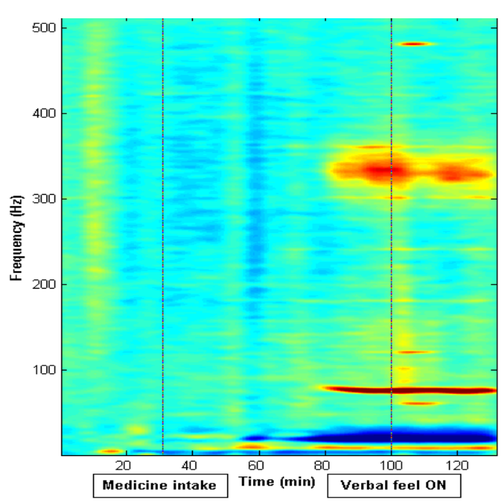
- **Do they need any adaptation?**



- Can we detect fluctuations in symptoms?
- Can we detect states such as sleep, awake?
- Can we tune stimulation for each patient?
- Can we extend battery life?
- Can we integrate sensors with neurophysiology?



Activa PC+S



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SENTIMENT ANALYSIS

“great hotel just outside city”

Reviewed 12 May 2016

Stayed here recently with friends,comfy room,and really good breakfast- and kettle in the room! Easy to get around city,and bus from airport tfor just 2.15 euro Dont have anything from mini-bar in fridge,supermarket and 24hr garage shop nearby !

Sentiment analysis (or *opinion mining*) = the “computational treatment of opinion, sentiment, and subjectivity in text” (Pang & Lee, 2008)

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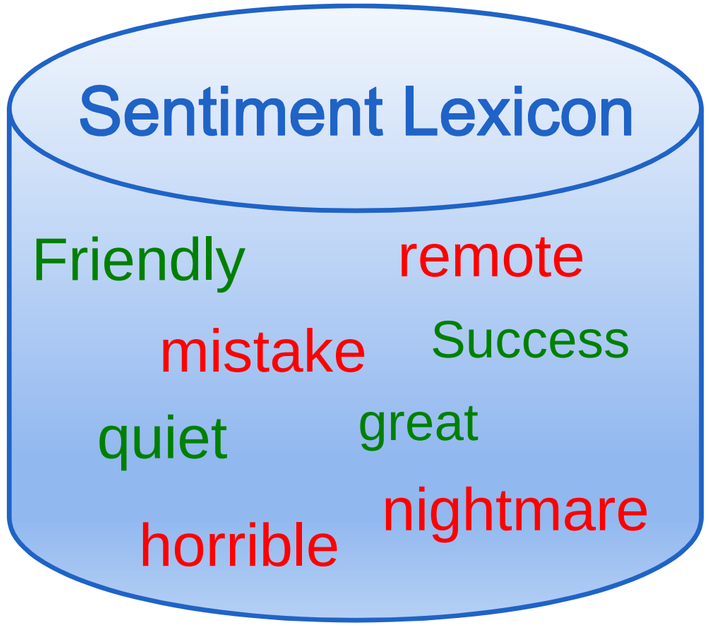
ELS LEFEVER: SENTIMENT ANALYSIS

Friendly staff,
Very quiet location,
bit remote though.

Machine learning approaches to predict polarity: “positive”, “negative” or “neutral” label

Incremental learning: system is designed as a semi-supervised intelligent system, which improves in each iteration as we get more training data



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ELS LEFEVER: SENTIMENT ANALYSIS

TOPIC 1: context-specific sentiment analysis

➢**Domain-adaptation**: retrain on domain-specific corpus (e.g. “predictable” for a movie plot /vs/ car’s steering abilities) > supervised/unsupervised

➢**Context-specific**: pattern-matching, co-occurrences, machine learning, etc.

E.g. low salary /vs/ low cost
high resolution /vs/ high cost
high quality /vs/ high price
lazy Sunday /vs/ lazy guy

=> problem: need for labeled data, within same domain

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TOPIC 2: implicit sentiment analysis

➢How to capture "world knowledge" in an automated way?

The phone **lasts all day** (implicit: "good battery")
=> how to automatically extract the (implicit) aspect + sentiment

Going to the dentist this afternoon. Can't wait. (implict: "negative sentiment")
=> how to model "prototypical sentiment" of phrases?

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