

Hello,
(brain)coders !

BCC_wk0

Agenda

- มาแนะนำตัวกันเถอะ! (ผู้เรียนพบผู้สอน) [10-15นาที]
- ทบทวนเนื้อหาพื้นฐาน (สั้นๆ) [20-30นาที]
 - Cognitive Neuroscience
 - Computational modeling
 - Clinical & non-clinical Application
- ความคาดหวัง และ ไลจิสติกส์ [20นาที]
- Q&A [10-15 นาที]



มาแน่นำตัวกันเถอะ!

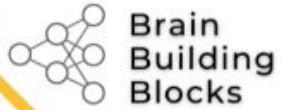




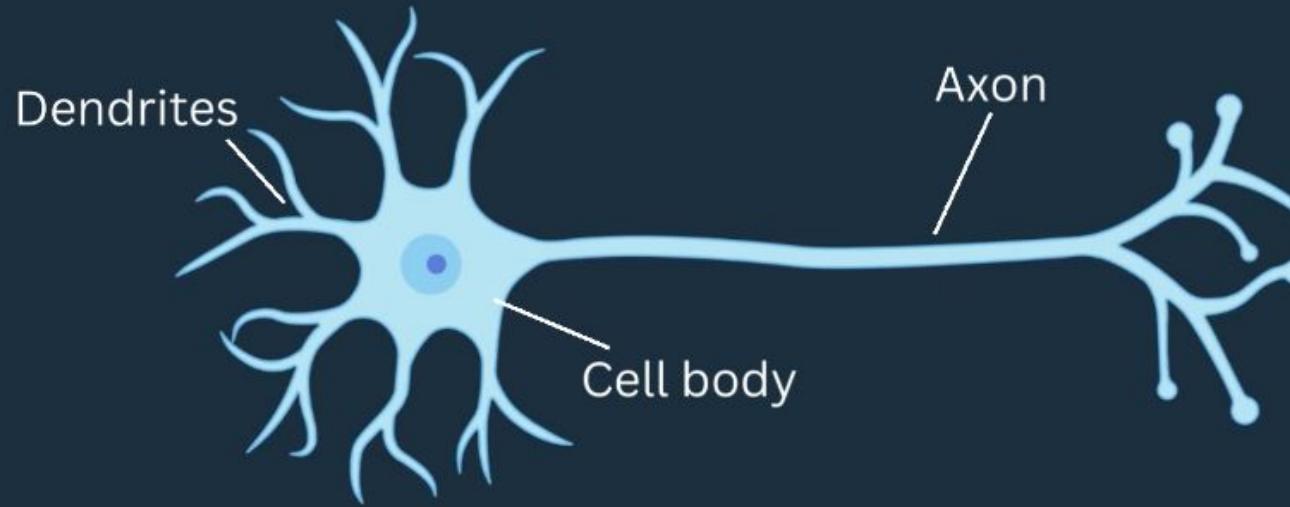
Agenda

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Neuron

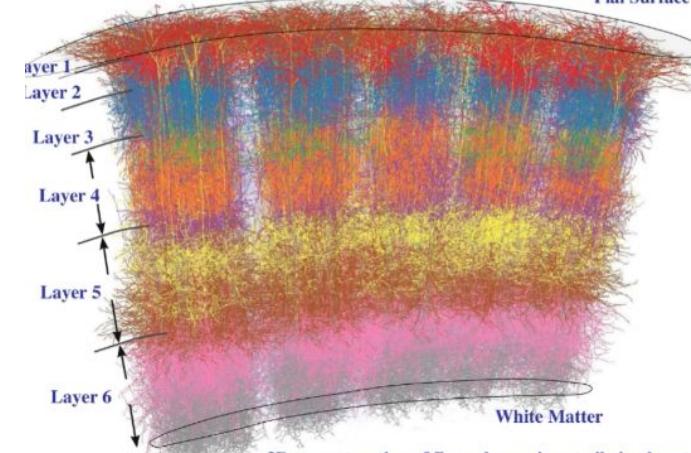
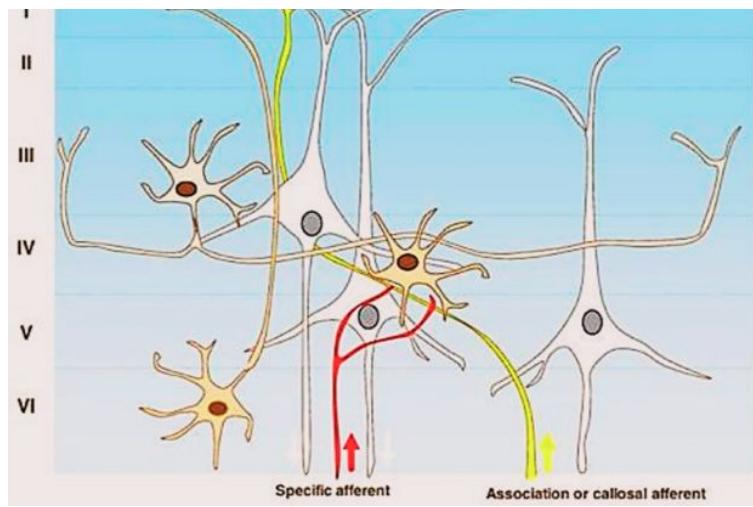


Speaker: Sekh Thanprasertsuk, M.D.

Session 1: Introduction

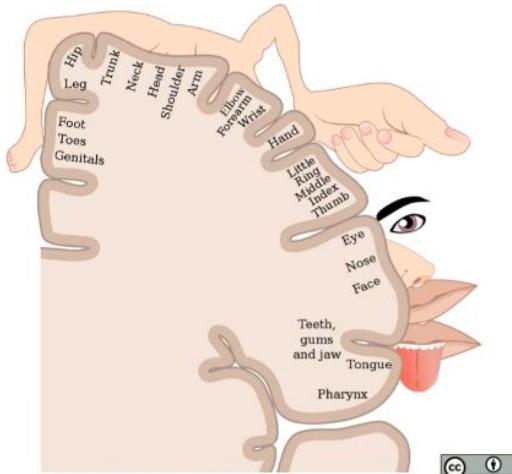
Module 2: Essential Neuroanatomy



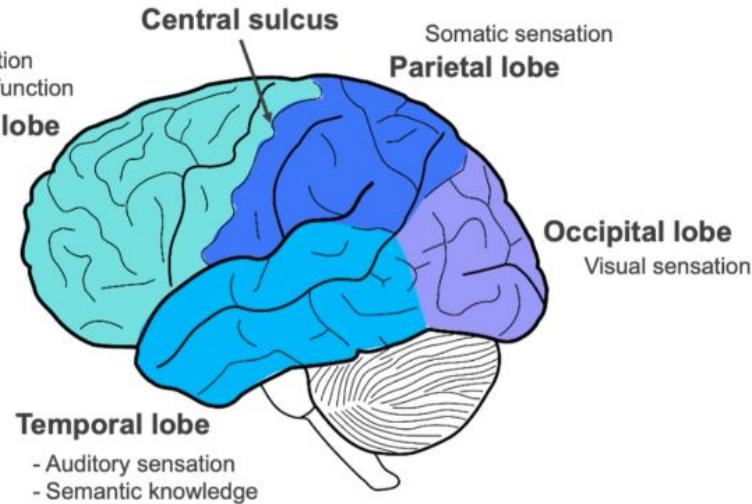


Underlying image from:
Marcel Oberländer, Beyond the Cortical Column, Neuroinformatics 2012

CC BY-SA 4.0



- Motor function
 - Executive function
- Frontal lobe**

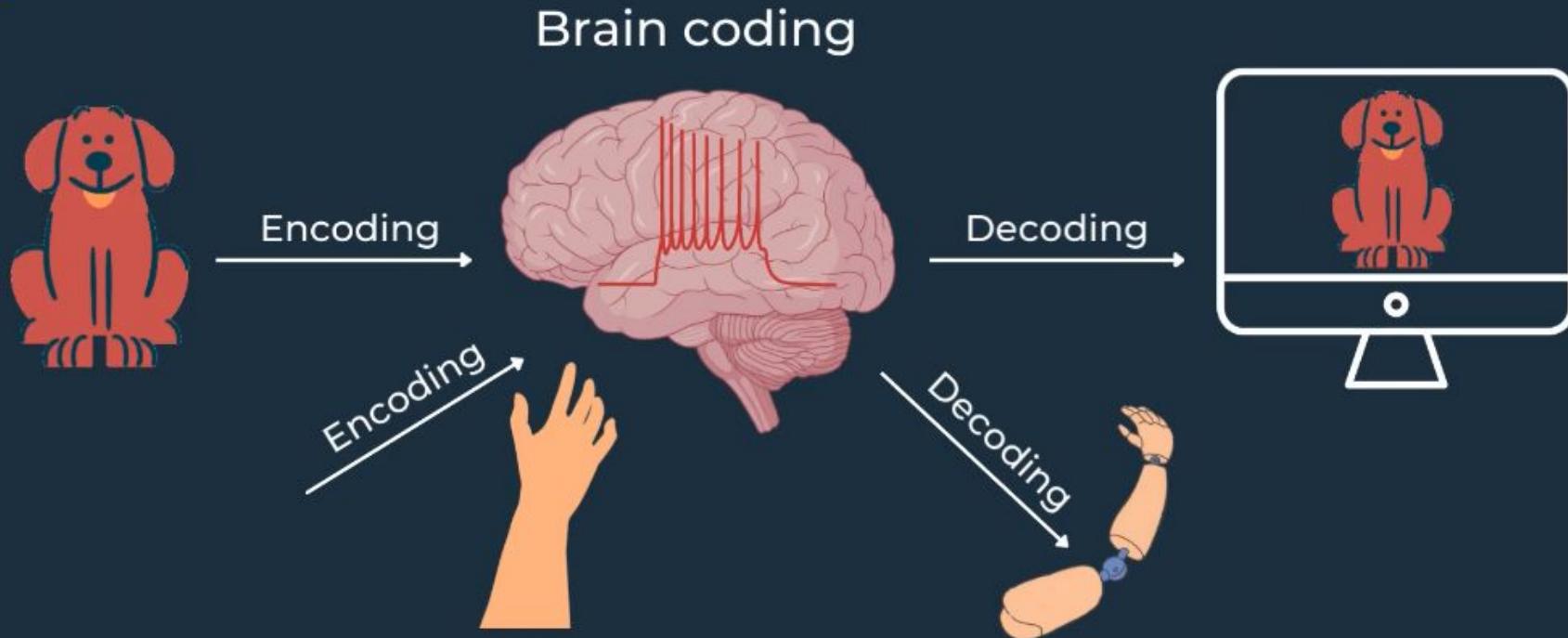


Neurotransmitters

Small molecule	Neuropeptide	Gas
<ul style="list-style-type: none">• Amino acids (glu, GABA)• ACh• Monoamines• Purines• Etc.	<ul style="list-style-type: none">• Opioids• Cannabinoids• Substance P• Etc.	Nitric oxide



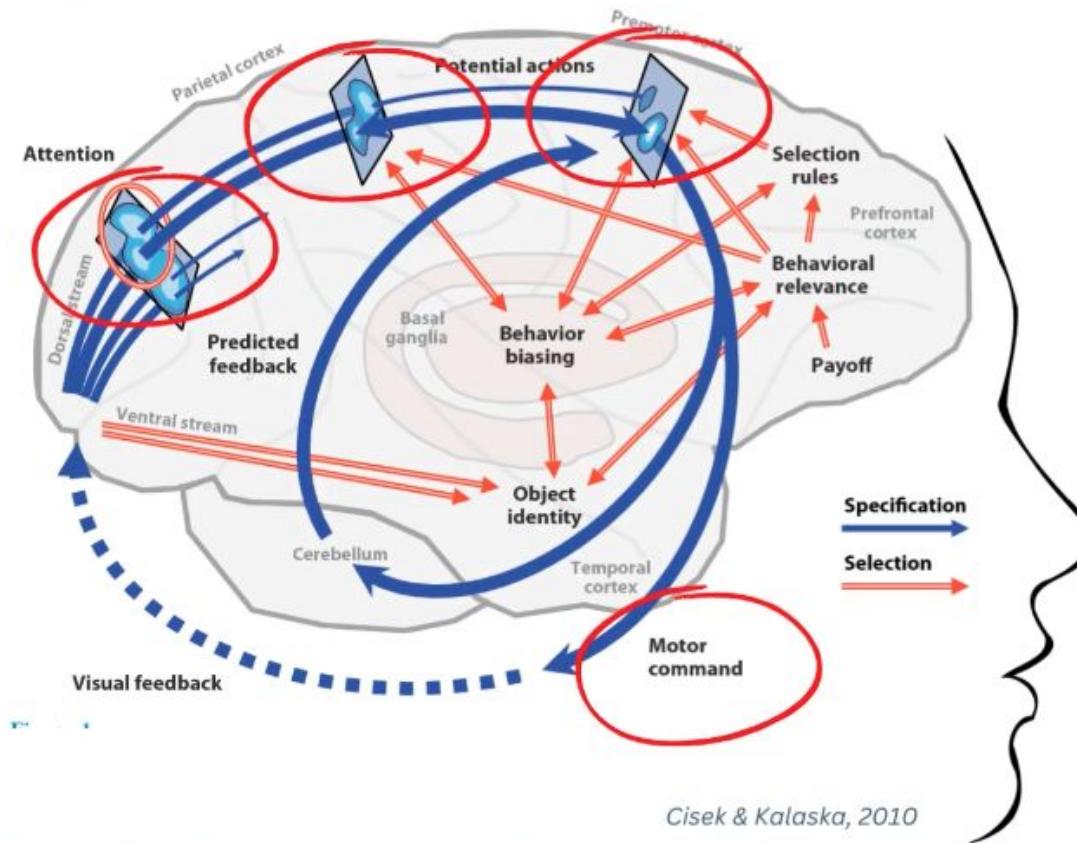
Encoding and Decoding





Sensorimotor transformation

Parietal cortex
↓
Premotor cortex
↓
Motor command

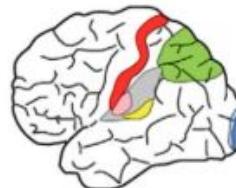


Cisek & Kalaska, 2010

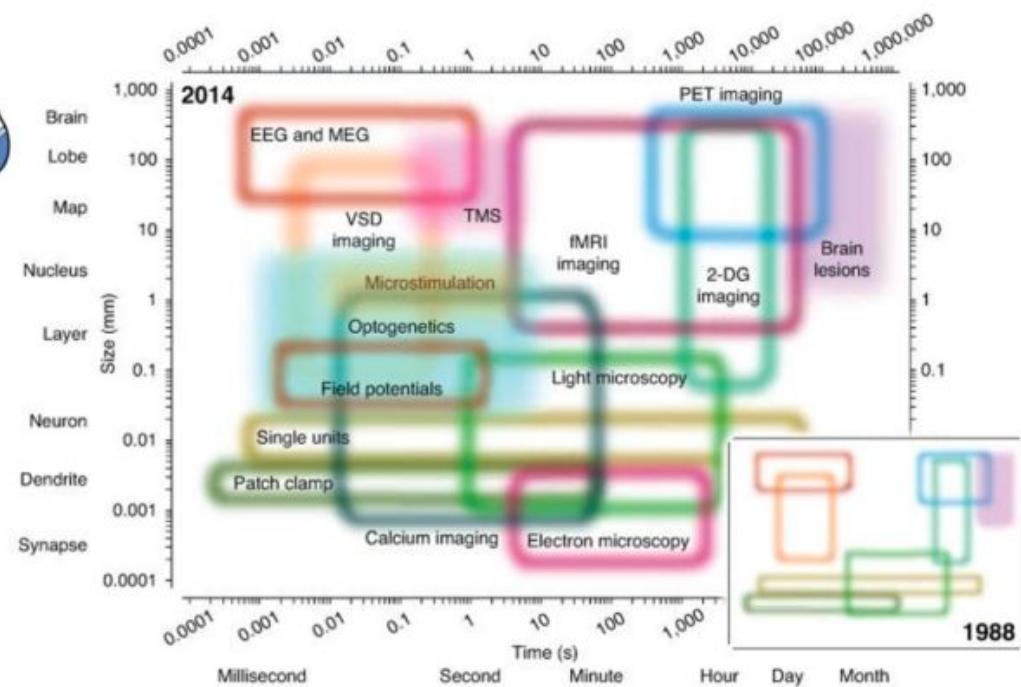
-20-



Mapping brain functions with different neuroscience methods



Speaker: Sirawaj Itthipuripat



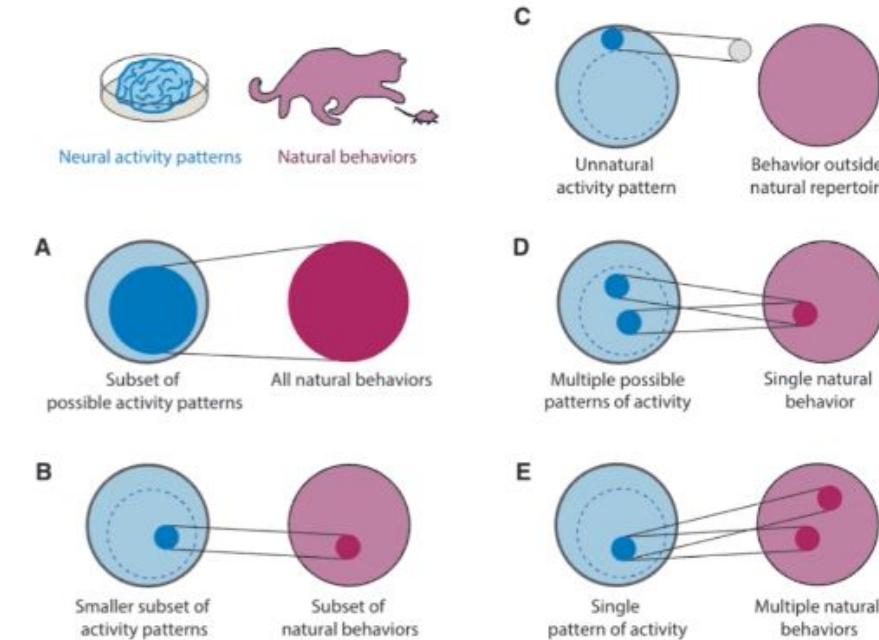
Sejnowski, Churchland & Movshon (Nature Neuroscience, 2014)

Session 2: Method

Module 1: Multimodal Neurotechnology



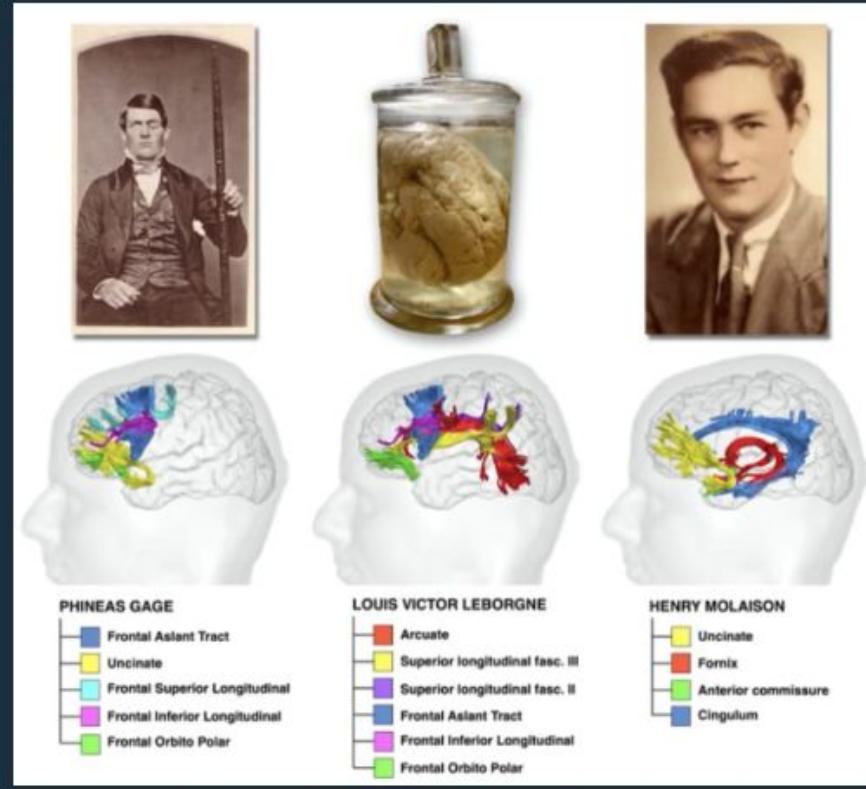
Neuroscience Needs Behavior: Correcting a Reductionist Bias



Krakauer et al., 2017



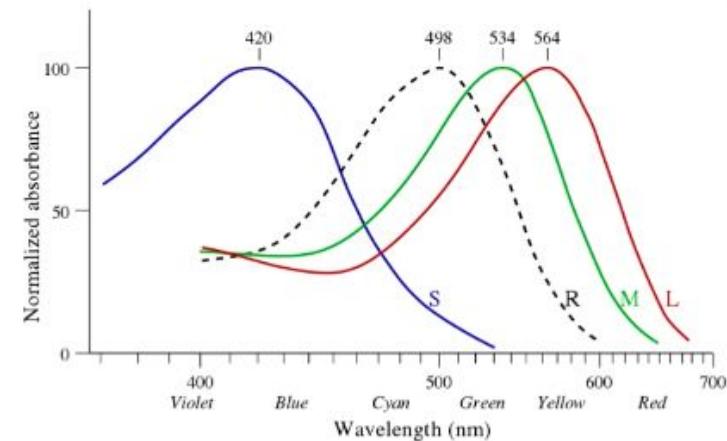
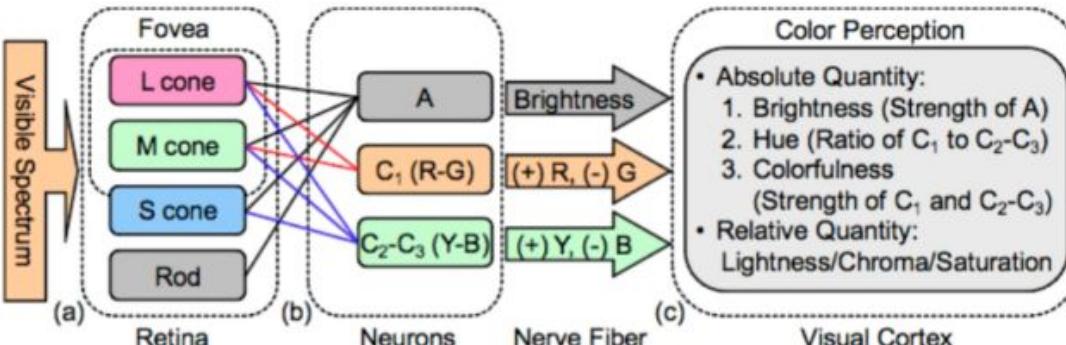
Use of advanced neuroimaging technique



Schotten et al., 2015



Biology study base on behavior



Sudthapong Chunamchai

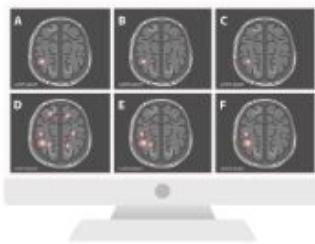
Session 2: Method

Bowmaker J.K. and Dartnall H.J.A, 1980.

Module 3: Behavioral measurements

Brain
Building
Blocks

Pipeline



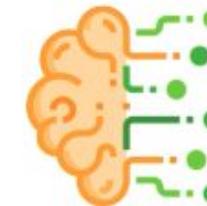
Incoming Data



&



Exploratory Data Analysis



Modeling and
Interpretation



Insights

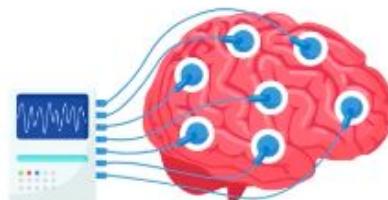


Brain
Building
Blocks

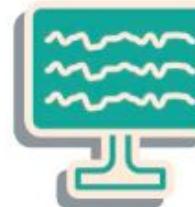
Basic Data Understanding



EEG



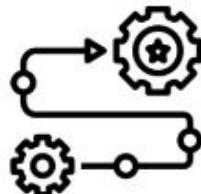
Modality



Task: Motor imagery

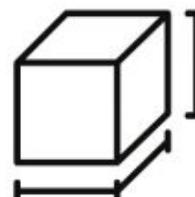
64 electrodes
256 samples/s
2 s recording
100 repetitions

Acquisition Process



No preprocessing
Filtering
Trial rejection

Preprocessing



$64 \times 256 \times 2 \times 100$
 $64 \times 512 \times 100?$
 $64 \times 51,200?$
 $100 \times 64 \times 512?$

Data Dimension

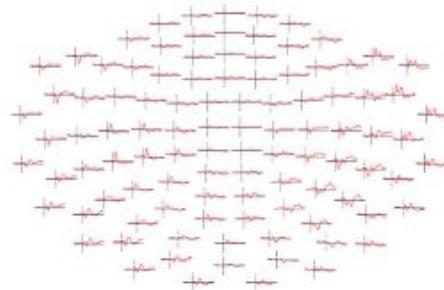
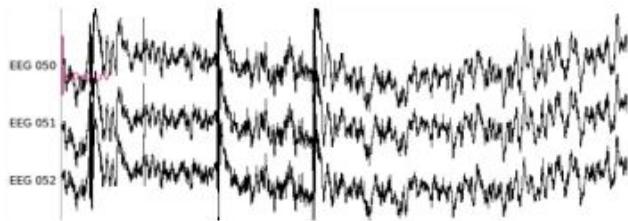


Brain
Building
Blocks

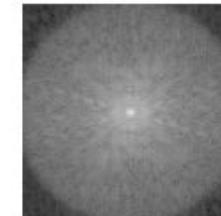
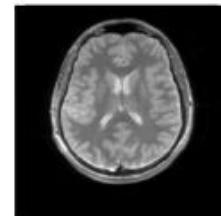
Data Visualization



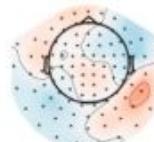
Spectra



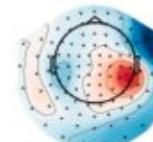
Images



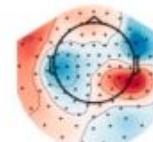
-0.200 s



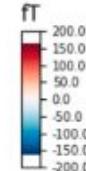
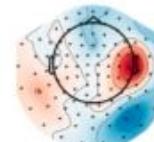
0.033 s



0.266 s



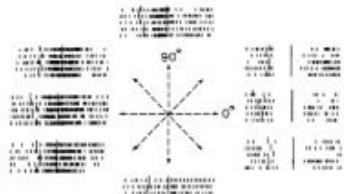
0.499 s



Source: MNE

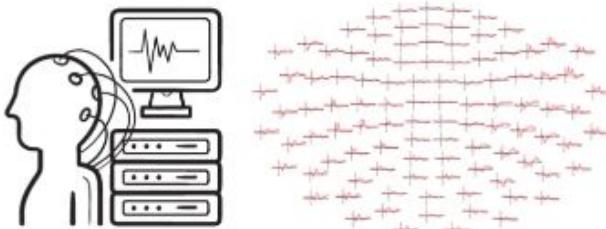


Brain
Building
Blocks



Neural spiking: (t, neurons, trial conditions)

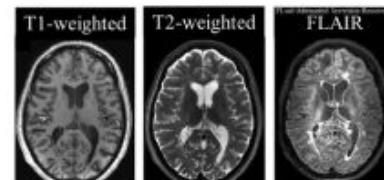
Dayan P and Abbott LF. MIT Press (2005)
Chestek CA et al. JNeurosci (2007)



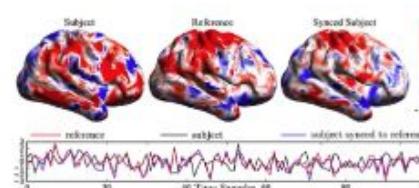
EEG: (channels,t)

MNE's overview of MEG/EEG analysis with MNE-Python

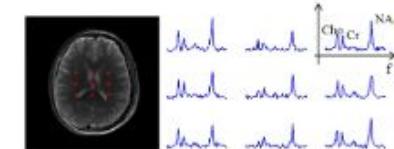
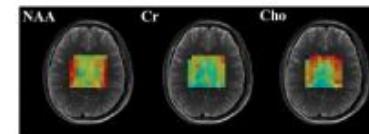
What's Next?



Structural MRI: (x,y,z)
De Graaf WL et al. Eur Radiol (2013)



fMRI: (x,y,z,t)
Joshi AA et al. NeuroImage (2018)



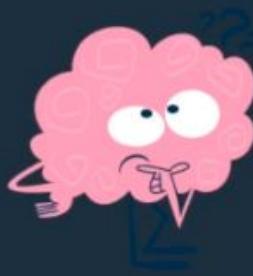
MR spectroscopic imaging: (x,y,z,f)
Chatnuntawech I et al. MRM (2015)

After we have made sure that we have acceptable data quality,
how do we gain some insight into them?

ศาสตร์และศิลป์แห่งการปันโนเดลคณิตศาสตร์



What is your question?



What models:

- Understand the DATA
- Able to summarize and create a toy example
- No promises about meaning...

How models:

- How does the SYSTEM work?
- Know how to tinker... (what would happen if ...?)

Why models:

- Which things matter?
- Are they optimized?
- Understand the GOAL (Why it does the way it does?)



David Marr's 3 levels

The three levels at which any machine carrying out an information-processing task must be understood



Implementation level (hardware):

- How can the representation and algorithm be realized physically?

Algorithmic level:

- What is the representation of the input and output?
- What is the algorithm for the transformation?

Computational theory level:

- What is the *goal* of the computation?
- Why is it appropriate
- What is the logic of the strategy by which it can be carried out?



Transparent vs Blackbox



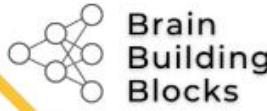
Transparent models:

- We (humans!) can understand it
- Easier to investigate (and fix)
- Parsimonious (Simpler) > Complex
- Usually less predictive power

Blackbox models:

- Complex models with many parameters
- Harder to comprehend, investigate, fix
- Strong predictive power



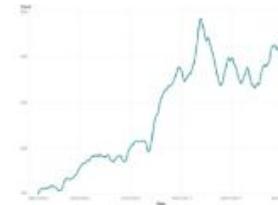


How to select the best model?

Quick step-by-step

- **Step 1:** Choose proper validation strategy
 - Random split, Time-based split, k-fold cross validation
- **Step 2:** Choose the right evaluation metric
- **Step 3:** Keep track of experimental results
 - metrics, learning curves, dataset versions, configurations
- **Step 4:** Compare experiments and pick a winner

Step 1: Choosing proper validation strategy



Speaker: Titipat Achakulvisut

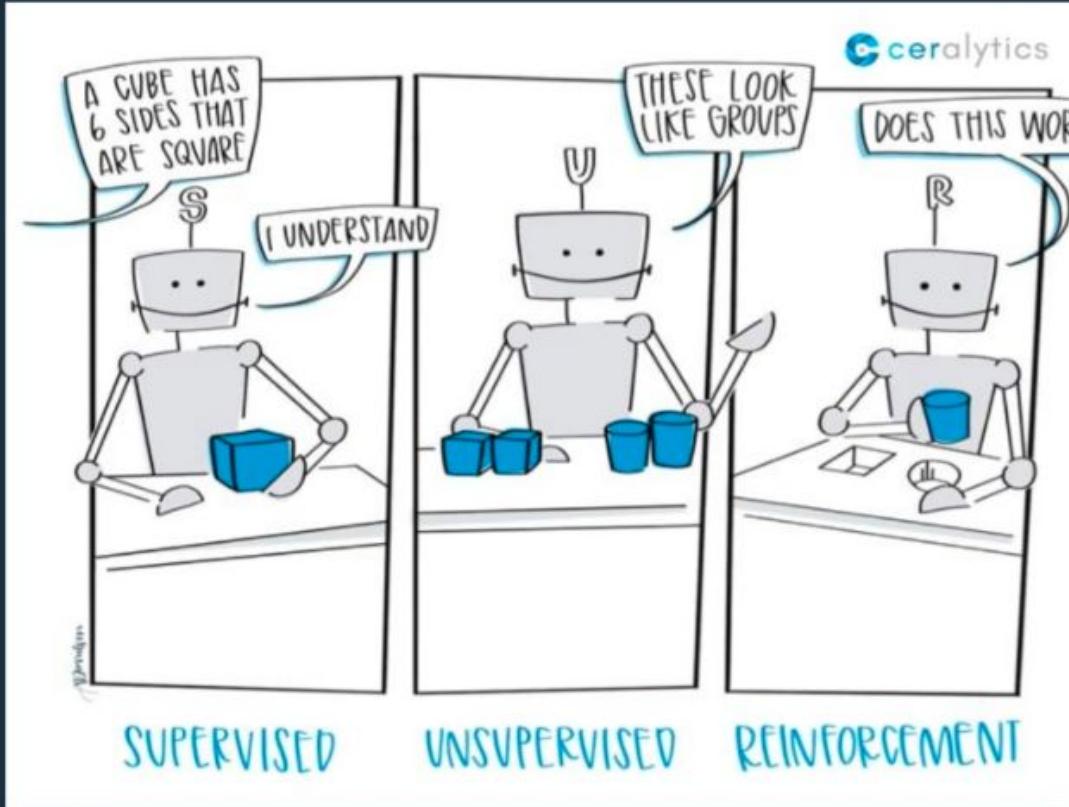
Session 6: Data Modeling

Module 4: Model Evaluation

<https://neptune.ai/blog/ml-model-evaluation-and-selection>



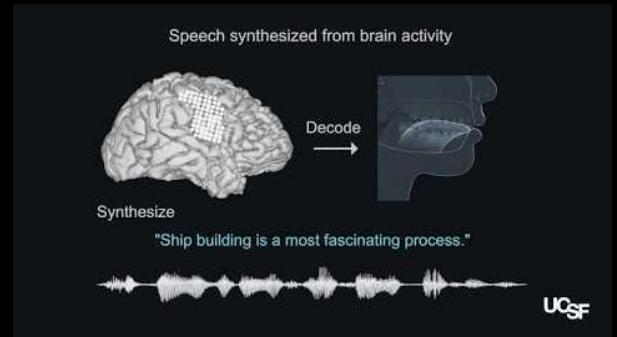
Machine learning



คำถามชวนคิด

- Q1: สมมติว่าเราสนใจว่า ... เราจะพิสูจน์ยังไง ใช้เครื่องมืออะไร
- Q2: นักวิทยาศาสตร์เสนอแบบจำลอง ... แบบจำลองแบบที่ว่าเป็นโมเดลประเภทไหนกันนะ?
- Q3: ถ้าเรามีข้อมูลแบบ X และอยากจะตอบคำถาม Y เราจะใช้ ML แบบไหนดี ประเมินยังไง
- Q4: ...

จะรู้ไปทำเพื่อ!?



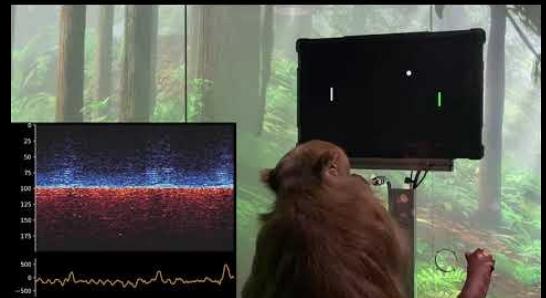
Real world applications



Million Stories presents
Your Brain on Money
a **BIG THINK** original series
This is your brain on money.



TRIBECA
FESTIVAL
2017

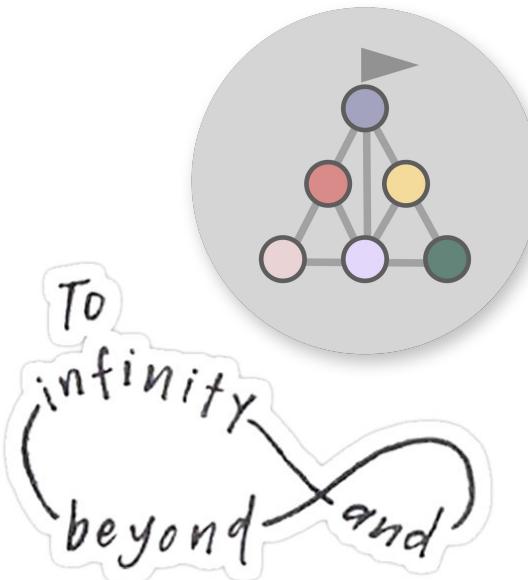


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- Q&A [10-15 นาที]



What's next?



- Learn about cool stuffs
- Pick the topic & dataset you like
- Work closely with the team
- Coding
- More coding
- Even more CODING!
- Learn from each other
- Present your cool project
- Join our brainHackathon® event
- Put your name & work on the **TALENT THAILAND!**
- Present your work to the world!

Digging into real data!

- OpenNeuro (<https://openneuro.org/>)
- Nature Scientific data (<https://www.nature.com/sdata/>)
- Kaggle (<https://www.kaggle.com/>)
- Open Science Foundation (OSF) (<https://osf.io>)
- More...
 - Alzheimer Disease Neuroimaging Initiatives* (ADNI, <https://adni.loni.usc.edu/>)
 - Human Connectome Projects* (<https://db.humanconnectome.org/>)
 - Neurodata without borders (<https://www.nwb.org/>)
 - National Alzheimer's Coordinating Center* (<https://naccdata.org/>)
 - Brain/MINDS DATA PORTAL (<https://dataportal.brainminds.jp/>)
 - Neuroscience Information Framework (<https://neuinfo.org/>)

(*permission needed)



OpenNEURO

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A free and open platform for validating
and sharing BIDS-compliant [MRI](#), [PET](#),
[MEG](#), [EEG](#), and [iEEG](#) data

34,370 Participants

886 Public Datasets

Browse by Modalities



Or

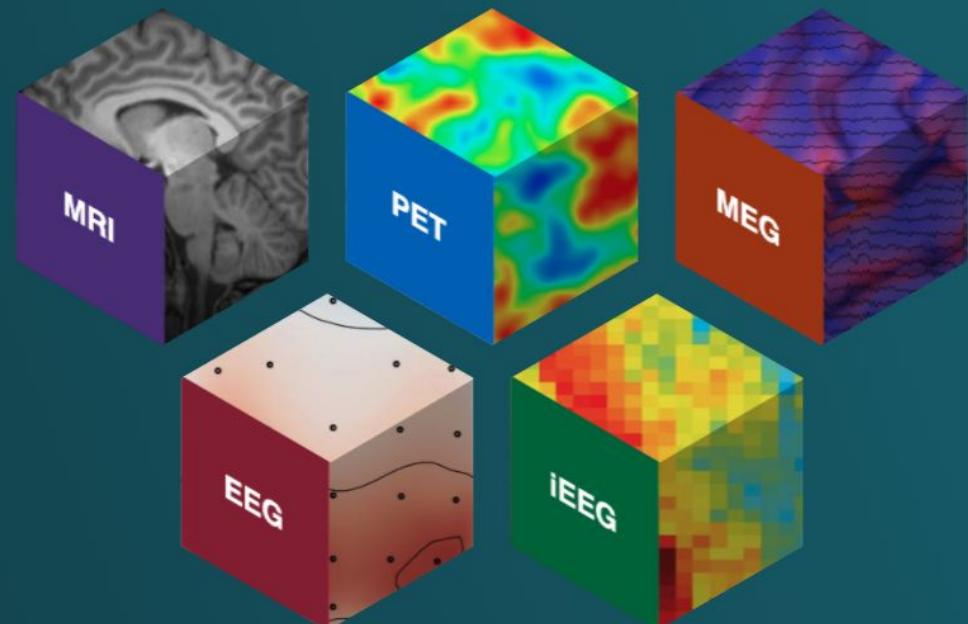
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Search

Search [Advanced search](#)**Journal****Article type****Subject****Date**[Clear all filters](#)**Sort by:** Relevance Date published (new to old) Date published (old to new)

Showing 1–50 of 9919 results

Research**Open Access**

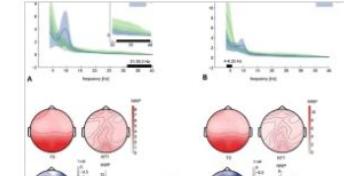
09 Aug 2023

Scientific Reports

Volume: 13, P: 1–8

Abnormal spectral and scale-free properties of resting-state EEG in girls with Rett syndrome

Olga Sysoeva, Vladimir Maximenko ... Alexander Hramov

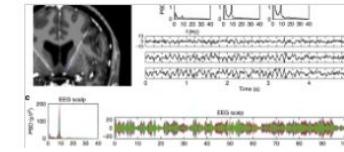
**Research****Open Access**

14 Feb 2019

Nature Communications

Subcortical electrophysiological activity is detectable with high-density EEG source imaging

Electroencephalography (EEG) allows the measurement of electrical signals associated with brain activity, but it is unclear if EEG can accurately measure subcortical activity. Here, the authors show that source dynamics, reconstructed from depth EEG, correlate with activity





EEG



All OSF Results

105177

Files

101699

Memory failure predicted by attention lapsing and media multitasking / eeg

Contributors: Kevin Paul Madore

Jump to: [Files](#)

Projects

1552

Registrations

811

STUDY 2a - mixed data on the experience of playing neurofeedback games / EEG

Contributors: Cyril Kaplan

Jump to: [Files](#)

Preprints

578

Components

531

Users

6

Improve your search:

[EEG](#) [ERP](#) [poster](#) [eeg](#) [fMRI](#)[emotion](#) [attention](#) [talk](#) [ERPs](#)[Electroencephalography](#)

Method / EEG (Registration)

Date Registered: 2020-12-13 11:06 PM

Contributors: Adrianna Adamska

Jump to: [Wiki - Files](#)

Data / EEG

Contributors: Nadine Schlichting - Prof. Dr. Ritske De Jong - Hedderik van Rijn

Jump to: [Wiki - Files](#)



Create

Home

Competitions

Datasets

Models

Code

Discussions

Learn

More

Your Work

Datasets

+ New Dataset

Your Work

EEG

Filters

All datasets

Computer Science

Education

Classification

Computer Vision

NLP

Data Visualization

Pre-Trained Model

247 Datasets

Hotness



EEG-Alcohol

Leonidas · Updated 6 years ago

Usability 7.1 · 948 Files (CSV) · 301 MB

103

Bronze ...



Confused student EEG brainwave data

Haohan Wang · Updated 5 years ago

Usability 7.9 · 12 Files (other, CSV) · 114 MB

367

Gold ...



EEG Analysis

Jean-MarcBouvier · Updated 4 years ago

Usability 7.6 · 2 Files (CSV) · 4 MB

46

Bronze ...



Eye State Classification EEG Dataset

Rob Mulla · Updated a year ago

Usability 10.0 · 847 kB

63

Silver ...

Course logistics

- Communication:
 - Discord
- Office hours
 - TAs
 - Instructors
- Materials
 - <https://braincode101.github.io/>
 - <https://course-braincodecamp.web.app/>
 - <https://compneuro.neuromatch.io/>
 - <https://ai-builders.github.io/>



Discord

- Text Channel
 - Student - Student: #student-general
 - Student - Staff: #general
 - Private concerns: (DM) Mos Waragon P.
 - อยากรู้ channel เพิ่มโปรดแจ้ง Mos Waragon P.
- Voice Channel
 - ใช้ห้องไหนก็ได้
(ยกเว้นช่วง office hour ขอให้ใช้ห้องตามที่แจกแจง)



BrainCode2023

landing

37 new messages since 9:39 PM on July 5, 2023

Mark As Read NEW

Aom Chayanon 07/05/2023 9:39 PM
สวัสดีทุกท่านครับ ผู้สอน TA ครับ 😊
3 3

Mos Waragon P. 07/06/2023 10:33 AM
สวัสดีครับ คุณออม

July 6, 2023

hoggy Pittinan 07/28/2023 5:34 AM
สวัสดีครับ 👍
100 1

Play Piyatida 07/28/2023 6:38 AM
PlayPlatinum -> Student

Krit Kanokkrit 07/28/2023 6:43 AM
ยังไม่ได้รับ role ครับ MORNING_SKY -> student

Gaem Airin 07/28/2023 6:52 AM
สวัสดีค่ะ แก้มนะคะ -> student
100 2

Erk Sippanat 07/28/2023 6:54 AM
สวัสดีครับ เอ็กครับ -> student

Mos Waragon P. 07/28/2023 7:02 AM
สวัสดีครับ ผู้สอน -> TA ครับ

Message #landing

cchunharas cchunharas

INFORMATION

announcement

welcome-and-rules-staff

GENERAL-TEXT-CHANNEL

landing

student-general

staff-general

general

VOICE CHANNELS

Lounge

Study Room 1

Study Room 2

Study Room 3

Study Room 4

Play Room

E-sport room

STAFF-SPACE

toolbox

mos-space

NEW MENTIONS

Gift GIF Image Smile



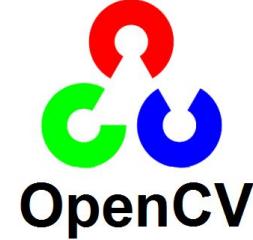
Office hour (OH) Wednesday 19.00 - 20.30

- Agendas
 - กิจกรรมส่วนกลาง C-Room (~20 mins)
 - Meet the instructors
 - Q/A เนื้อหาที่เรียนรายสัปดาห์
(ส่งคำถามได้ที่ <https://forms.gle/mJADxp6hLGYs4oNH8>)
 - ซึ่งจะข้อมูลเพิ่มเติมจาก staff
 - กิจกรรมกลุ่มย่อย
 - พูดคุยถาม-ตอบเกี่ยวกับบทเรียน (~15 mins)
 - รายงานความก้าวหน้า mini - project (~ 15 mins)
- Voice channel
 - C-Room สำหรับกิจกรรมร่วม หรือคุยกัน
 - Classroom-{number} สำหรับกิจกรรมกลุ่มย่อย {number} (หากมี)
 - Playroom สำหรับกิจกรรมบันเทิงต่างๆ

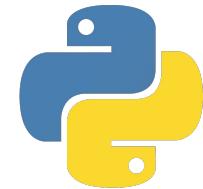
Outside Office hour

- สามารถติดต่อ TA ได้ทาง discord ตลอดเวลา (แต่ TA ก็ต้องนอนนะ)
- หากไม่เข้าใจบทเรียน สามารถขอความช่วยเหลือจากพี่ TA หรือเพื่อนๆที่อยู่ในกลุ่ม
- หากมีปัญหาหรือข้อสงสัยเกี่ยวกับภาพรวมของค่าย หรือเรื่องจิปาถะ สามารถสอบถาม TA หรือ Mos Waragon P. (ซึ่งมันดูจะว่างกว่า TA คนอื่นๆ) จะพยายามแก้ปัญหาและคลายความกังวลให้ตลอดระยะเวลาค่าย

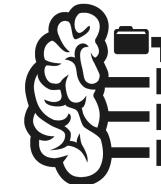
Know your weapons



NumPy



python™



BIDS
BRAIN IMAGING DATA STRUCTURE



Timeline & commitment

- Timeline
- ทบทวนบทเรียนและส่งคำถามก่อนมาเจอกันแต่ละอาทิตย์
- ทำงานร่วมกับ #ทีมพี่เลี้ยง
 - ได้หัวข้อก่อน wk3
 - ข้อมูลพร้อมวิเคราะห์ก่อน wk 5
 - ได้ผลการทดลองก่อน wk10
- ส่งผลงาน
 - สนุก + ได้ความรู้ > แกรมไบประกาศนียบัตร
 - นำเสนอผลงานช่วงท้ายของแคมป์
 - เขียนบทความลงใน blog

AI Builders Showcase

2022

2021

A Lip Reader
พุทธคุณ บุญชัย (ข้าวตู)

แมงดาจาน “กินได้”
แมงดาดัก “มีพิษ”
กรอบควบคู่ไปกับ เครื่องเดิมแบบเดิม
AI แยกแยกแมงดาจาน กับ แมงดาดัก
ภัคพล อาจบุราษย์ (หลุยส์)

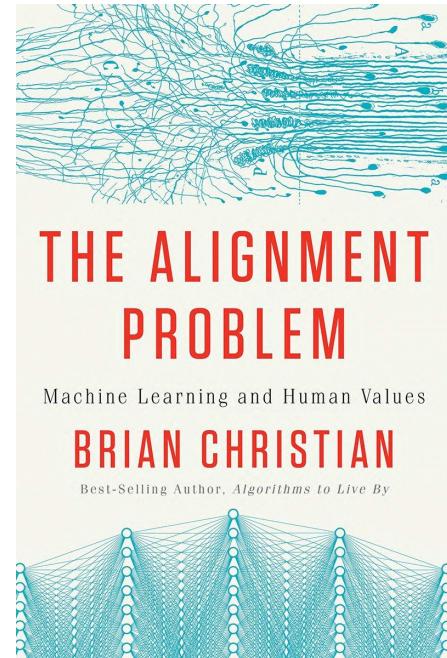
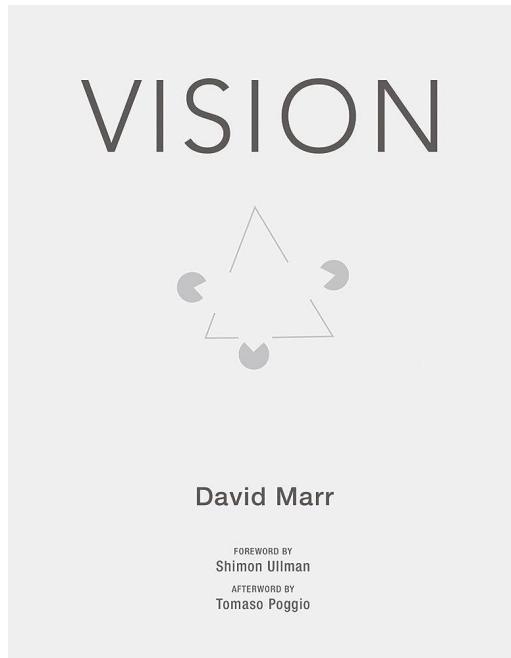
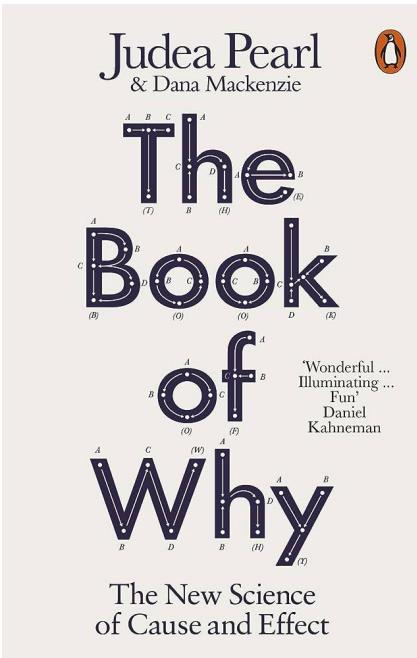
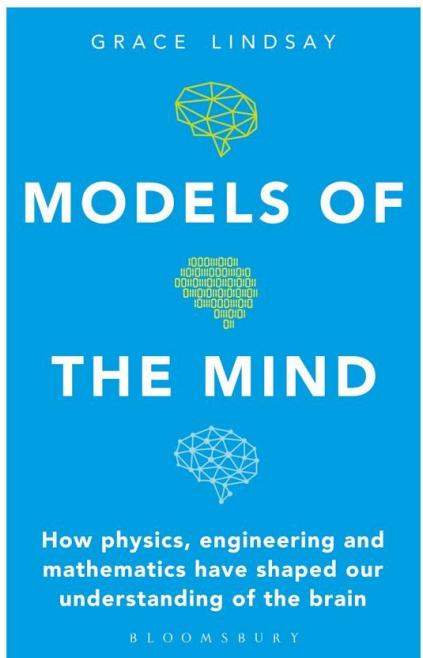
American Sign Language
กรกฤช แสงสว่าง (เบลล์)

Auto Lyric Recognizer
กิตติพงศ์ เพพอยู่ (ปัน)

Automatic E2E Thai Question Generation with MT5
บรินท์พัฒน์ เพ็งพันธุ์ (ปริน)

WHAT IS BACK?
MEANING
MODEL
BACK (Blind All Can Know) - Action Captioning for Bl...
เตติวัฒน์ ตึงสถาพร (ไนน์)

Suggested readings





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Big Think



CodeEmporium



Real Science



3Blue1Brown

Two Minute Pap...



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brainCodeCast

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Brain Building Blocks:
Session9, 2023

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Session8, 2023

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Brain Building Blocks:
Session4, 2023

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Brain Building Blocks:
Session5, 2023

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Brain Building Block (full set)

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Brain Building Blocks:
Session6, 2023

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Brain Building Blocks:
Session7, 2023

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Brain Building Blocks:
Session3, 2023

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Brain Building Blocks:
Session2, 2023

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Brain Building Blocks:
Session1, 2023

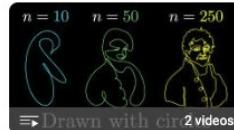
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signal processing

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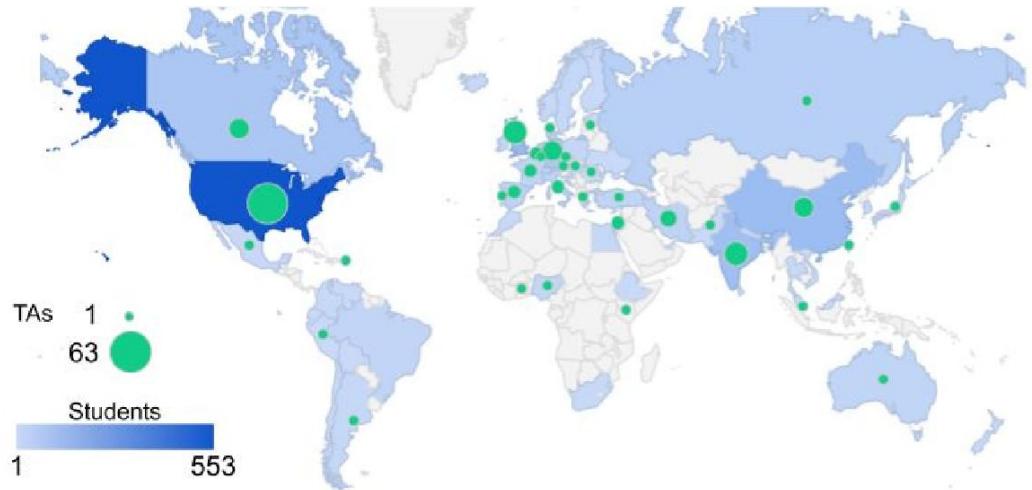
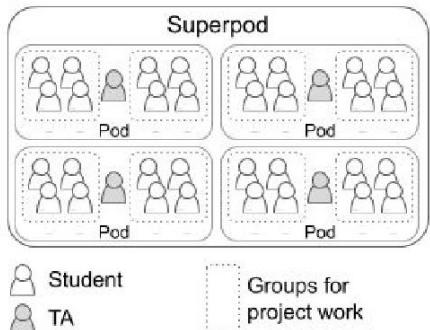
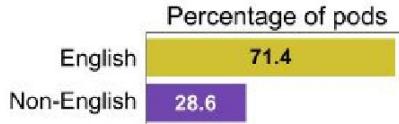
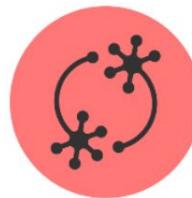
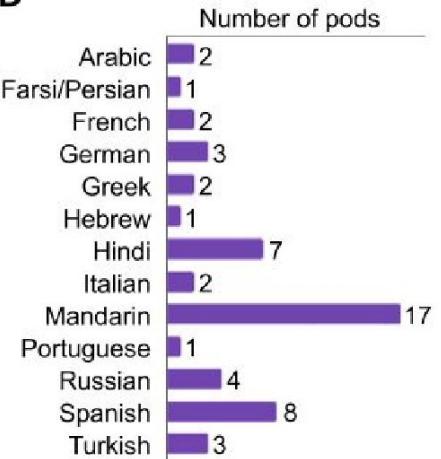
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cognition

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Explore

Trending

A**B****C****D**

neuromatch academy





แบบประเมิน



สไลด์ BBB



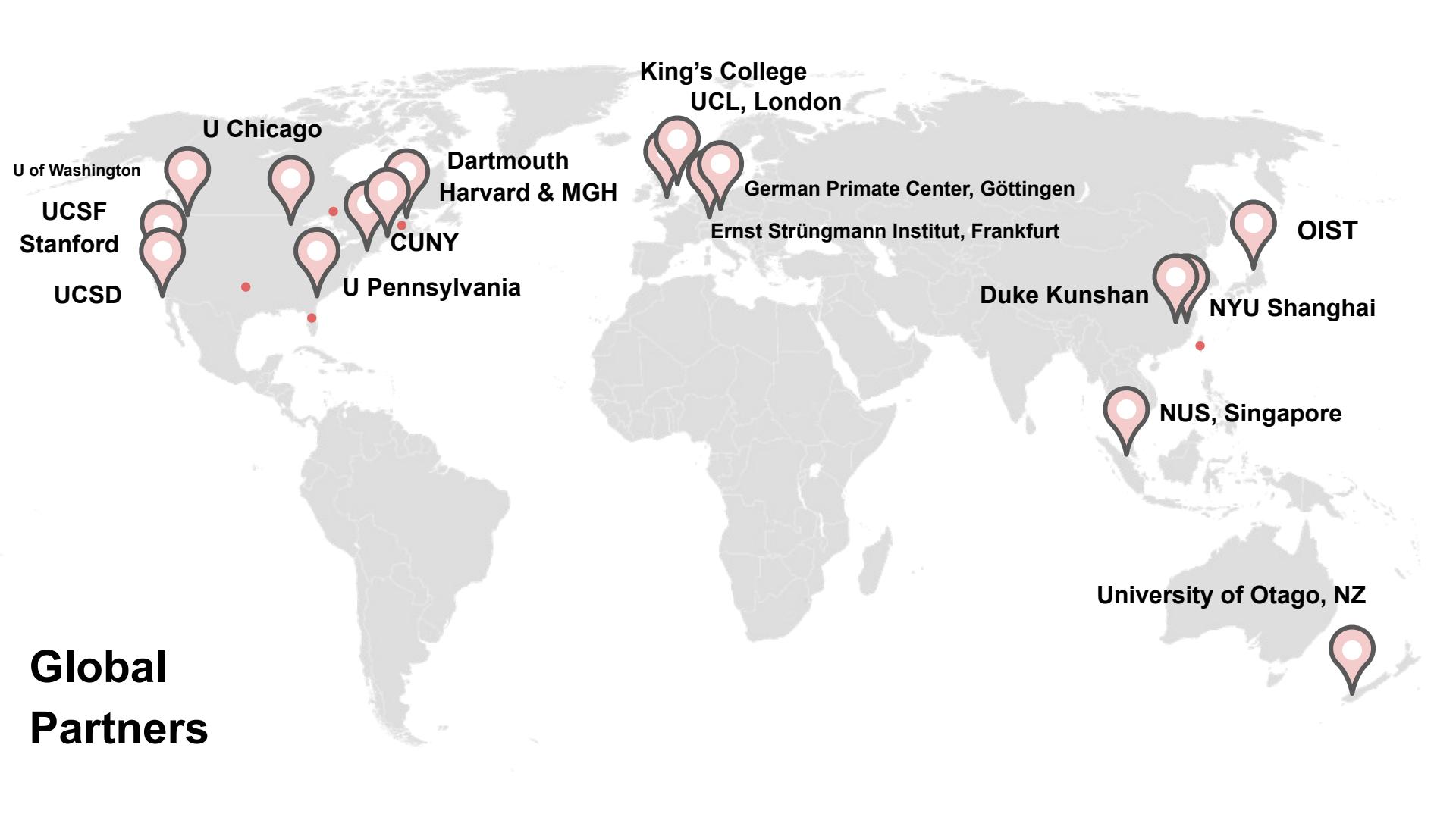
แบบทดสอบ



กล่องคำถาม

เพื่อประกาศนียบัตร

Global Partners

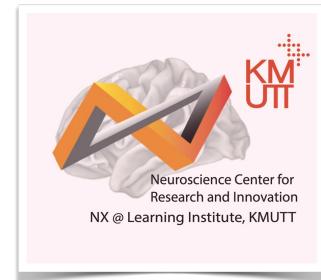




มหาวิทยาลัยมหิดล
คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี



RISC
RESEARCH & INNOVATION
FOR SUSTAINABILITY CENTER



Chulalongkorn
Stroke Center
King Chulalongkorn Memorial Hospital



ศูนย์ประสาทศาสตร์
โรงพยาบาลจุฬาลงกรณ์



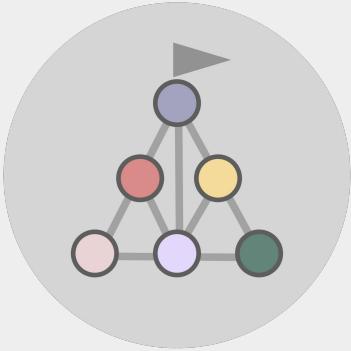
Downstream Partners



Q & A

Action plan

- ทบทวนบทเรียนใน BBB บางบท (โดยเฉพาะ session 6-7)
- ทำความคุ้นเคยกับ google colab
- ทำความเข้าใจบทเรียนของ brain code camp ล่วงหน้า
- หาความต้องการและชุดข้อมูลสำหรับ mini-project



Let's code !

BCC_wk1

Digging into real data!

- OpenNeuro (<https://openneuro.org/>)
- Nature Scientific data (<https://www.nature.com/sdata/>)
- Kaggle (<https://www.kaggle.com/>)
- Open Science Foundation (OSF) (<https://osf.io>)
- More...
 - Alzheimer Disease Neuroimaging Initiatives* (ADNI, <https://adni.loni.usc.edu/>)
 - Human Connectome Projects* (<https://db.humanconnectome.org/>)
 - Neurodata without borders (<https://www.nwb.org/>)
 - National Alzheimer's Coordinating Center* (<https://naccdata.org/>)
 - Brain/MINDS DATA PORTAL (<https://dataportal.brainminds.jp/>)
 - Neuroscience Information Framework (<https://neuinfo.org/>)

(*permission needed)