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Fermi Estimation

http://bit.ly/fermi19

Vox Populi

Middlemost estimate: 1207 lbs
True weight: 1198 lbs (0.8% under)

787 estimates

Source: Galton, *Nature* 1904

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The Wisdom of Crowds

- Diversity of opinion: Each person should have private information even if it's just an eccentric interpretation of the known facts.

- Independence: People's opinions aren't determined by the opinions of those around them.

- Decentralization: People are able to specialize and draw on local knowledge.

- Aggregation: Some mechanism exists for turning private judgments into a collective decision.

Source: Surowiecki, *The Wisdom of Crowds* 2004

COGS 108
Data Science in Practice

Version control

UC San Diego

This sucks

Voytek-NatNeuro-Craniectomy_2008Dec14.doc	Dec 16, 2008, 4:22 PM
Voytek-NatNeuro-Craniectomy_2008Dec26.doc	Jan 14, 2009, 5:26 PM
Voytek-NatNeuro-Craniectomy_2008Feb23.doc	Feb 23, 2009, 1:05 PM
Voytek-NatNeuro-Craniectomy_2008Jan14.doc	Jan 19, 2009, 9:54 PM
Voytek-NatNeuro-Craniectomy_2008Jan19.doc	Jan 20, 2009, 7:06 PM
Voytek-NatNeuro-Craniectomy_2009Mar4.doc	Mar 4, 2009, 10:03 PM
Voytek-NatNeuro-Craniectomy_2009Mar12.doc	Mar 12, 2009, 1:58 PM
Voytek-NatNeuro-Craniectomy_2009Mar16-FINALtoBOB.doc	Mar 16, 2009, 4:41 PM
Voytek-NatNeuro-Craniectomy_2009Mar20.doc	Apr 3, 2009, 6:08 PM

So does this

[redacted] Feb 26

Hi Brad (and everyone),

Attached is the manuscript incorporating all of our comments. I think most of the issues are fairly minor, which is great. To my mind, there are only two conceptual issues that we need to nail down before getting it back in:

1) The justification for a 100ms theta phase encoding window
2) The explanation for an earlier M1/PMC but later PFC response in some conditions

Brad, did you want to take a look through all the comments & make sure you agree with them? Maybe after you've had a chance to look, we can hammer out the answers to 1 & 2 above, if the way forward isn't already clear.

3 Attachments

Voytek-Hierarchy-2015Feb20_mddbak.doc
64 MB

Supplementary Methods

Data were collected from four subjects with intractable epilepsy who were implanted with chronic subdural grid electrodes as part of a pre-operative procedure to localize the epileptogenic focus. The surgeons determined electrode placement and treatment based solely on the clinical needs of each patient. Data were recorded at three hospitals: the University of California, San Francisco (UCSF) Hospital (subjects UC1 and UC2), the Johns Hopkins School of Medicine (subject JH1), and the Stanford School of Medicine (subject ST1). All subjects gave written informed consent to participate in the study in

Voytek-Hierarchy...

NN-A46881 – Oscillatory dynamics coordinating human frontal networks in support of goal maintenance

General Comment

We thank the editor and reviewers for their thoughtful comments regarding our manuscript. We were very pleased to read that one reviewer felt that our work "has the potential to significantly advance our understanding of brain…" and has introduced "an important methodological advance." Another reviewer noted that our, "findings present some of the best evidence to date on the manner in which the brains uses dynamic aggregations of neuronal ensembles to perform cognitive operations that control choice behavioral responding."

In addition, the reviewers pointed out very important issues and offered helpful criticisms. After much work, we have significantly reworked our analyses in response to these concerns, and we feel the manuscript is greatly strengthened as a result.

Voytek-Reviewer...

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And so does this…

[redacted] May 11

Hi Brad,

Thanks for chatting with me earlier today. I added the link to the visualization project into my resume and attached the resume. Thanks for any connections you can make for me. I'd love to know where you send it, so I can keep track of that. Thanks again!

Best,

[redacted] May 11

Actually, please use this one. I fixed a typo that was previously missed. Thanks!

[redacted] May 11

Final copy, I swear. Thanks for helping out.

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This is better

[new title?]
Spike-field coupling does not imply spike-spike synchrony.

The presence and function of oscillatory activity remains a major outstanding question in neuroscience. One prominent hypothesis for the functional role of gamma oscillations is 'communication through coherence'. This theory posits that regional oscillatory coherence enhances communication by increasing the precision of spike timing (spike synchrony). The focus on coherence has lead to biophysical investigations of spike synchronization between already oscillating populations. While important in establishing coherence as a useful biophysical communication mechanism~~property~~, and in showing how information flow is maximized when coherence is maximized, as of yet a basic question remains: ~~these studies skip over a basic question:~~ is spike-time precision enhanced by the onset and amplitude of gamma oscillations?

By definition, oscillating neural populations have periods of decreased firing. If all else is held equal, these periods of relative silence would mean a decrease in information flow. As firing declines so does information. If oscillations instead increase information flow, they must alter spiking to overcome these 'silent costs'. Keeping with the idea oscillations altering timing, and using Hodgkin-Huxley neurons in classic inhibitory-excitatory (E-I) configurations, we studied the effect of gamma onset and amplitude on spike precision and on information flow.

Our analyses suggest a much larger range of parameters can generate gamma oscillations, compared to only a narrow range of parameters that can actually increase precision and information transmission in excitatory neurons. For the cognitive theorist, our results suggest the 'communication through coherence' hypothesis may require stringent biophysical constraints. For the empirical researcher, our results urge increased caution in inferring spike-timing changes from changes to EEG/ECoG/LFP. Aggregating over all models, gamma power does not statistically predict spike precision, nor does a change to spike-field coupling imply change in spike-spike synchrony.

Revision history

Erik Peterson
May 4, 4:16 PM
Erik Peterson
May 4, 4:14 PM
Erik Peterson
May 4, 4:11 PM
Erik Peterson
May 4, 4:05 PM
Bradley Voytek
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Bradley Voytek
Restore this revision

Show changes

Show less detailed revisions

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This is even better

Kavli 2015

74 changes in **main.tex**

Restore to before these changes

basis of this proposal~~is an ideal place to start~~. Our functional model is based on ~~sub-components of~~ SPAUN, a 2.5 million spiking neuron model capable of completing 8 cognitive tasks using the same parameters \cite{Eliasmith2012}. SPAUN is divided into functional modules overlaid onto simulated cortical regions, including a parietal working memory (WM) center, prefrontal regions, a motor cortex, and a visual processing stream (V1 to 4). The dynamical portion of the modeling, which will oscillate in the gamma and high beta ranges (20-80 Hz) \cite{Tiesinga2004,Borgers2003}, will be implemented using the Brian library \cite{Goodman2008}.

\textit{\textbf{Experimental design.}}~~.~~

- Key idea: Re-embed (i.e. swap) synapses between dynamical and functional models. This is possible as b~~B~~oth models can use the same neuronal abstraction: leaky integrate and fire neurons with exponential synapses \cite{Brette2007,Eliasmith2012}.

- Architecture: To allow for re-embedding~~,~~ two regions of SPAUN must be ``tied''~~``tied''~~ to the two populations in the dynamic model. The first tie will be between t~~T~~he parietal/~~working memory (~~WM~~)~~ center of SPAUN, which already uses I-E attractor dynamics in its implementation. This WM center~~ (dubbed $P_{parietal}$)~~ will be tied to one of the dynamical populations.~~, $P_{attractor}$.~~ For the~~For the~~ second tie~~tying, i.e. targets creation,~~ we'll separately link~~examine~~ one of two select modules from SPAUN, either ~~---~~the dorsolateral PFC and the motor cortex, to the remaining attractor. In the native SPAUN implementation neither of these targets has oscillatory characteristics.

- Implementation: ~~-~~During all simulations the ``serial digit WM'' task from \cite{Eliasmith2012} will used. For the first dynamic-function pair~~rom two opposing target populations~~ (e.g. $P_{attractor2~~-~~'} \rightleftarrows P_{DLPFC}$), k neurons will be randomly selected. The weights, voltages, delay times, and conductance's for the selected synapses are then swapped (i.e. embedded) into the other model and the outcome is observed (see `Assessment'). This procedure is r~~R~~epeated every N simulation time-steps until T, the simulation run time, or all synapses~~$\operatorname*{arg\,min}_k P(k)$ synapses~~ have been re-embedded~~used~~. At termination t~~T~~he system will then be reset, the alternate ~~target~~ pair activated (e.g. $P_{attractor2~~-~~'} \rightleftarrows ~~s~~ P_{motor}$) and the whole process is repeated.

- Assessment: SPAUN and dynamical model properties will be assessed using standard methods (i.e. phase locking, oscillatory power and parametric stability, synchrony). Additionally, SPAUN generates responses ~~by drawing numerical digits~~ using a virtual robotic arm \cite{Eliasmith2012} allowing for ``behavioral'' analysis (i.e. accuracy \& reaction time).

- Key questions: (a) How much functional perturbation can the attractor withstand before collapse. (b) Before collapse how does it incrementally increasing bias alter oscillatory dynamics? (c) Does performance of SPAUN improve as coupled oscillations begin, as some theories cognitive theories would suggest \cite{Fries2009a}, or (d) does it decline?

~~-~~

~~-~~

~~- Viability: EJP spent part of summer 2014 working with the SPAUN team to begin implementing ``cognitive aging'' in the architecture [in progress]. For the last year EJP has worked on self organized E-I oscillations, examining the biophysical limitations of various cognitive theories of oscillatory communications [publication forthcoming].~~

\textsc{\textbf{Impact.}}~~.~~

Synaptic re-embedding is a hypothesis. We propose that small sub-populations of neurons can be usefully embedded in an attractor field, and that such an embedding can enhance function by synchronize spike timing \cite{CTC}. Such an embedding is very consistent with recent reports on the surprisingly functional diversity of principle cells, which are usually seen as homogeneous \cite{Krook-Magnuson2012}.

5 more updates below

\begin{itemize}

main.tex	2:35 pm
Erik Peterson	
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Erik Peterson	
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Wed, 29th Apr 15	
main.tex	11:21 pm
Erik Peterson	

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Version control

- Enables multiple people to simultaneously work on a single project.

Source: Michael Ernst, *University of Washington*

Version control

- Enables multiple people to simultaneously work on a single project.
- Each person edits their own copy of the files and chooses when to share those changes with the rest of the team.

Source: Michael Ernst, *University of Washington*

Version control

- Enables multiple people to simultaneously work on a single project.
- Each person edits their own copy of the files and chooses when to share those changes with the rest of the team.
- Thus, temporary or partial edits by one person do not interfere with another person's work.

Source: Michael Ernst, *University of Washington*

Version control approaches

Source: https://insights.stackoverflow.com/survey/2017#work-version-control

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git

git

the version control system

~ Track Changes from Microsoft Word....on steroids

GitHub (or Bitbucket or GitLab) is the home **where your git-based projects live** on the Internet.

~ Dropbox....but way better

git

```
$ git clone https://www.github.com/username/repo.git
$ git pull
$ git add -A
$ git commit -m "informative commit message"
$ git push
```

Terminal

git

GitHub

git GUIs

GitHub Desktop

SourceTree

Why version control?

Collaboration

Returning to a safe state

Exposure for your work

Tracking others' work

Why version control?

Collaboration

Why version control?

Returning to a safe state

You're free and safe to **try things out locally**. You'll only send changes to the repo when you're at a stable point

Why version control?

Exposure for your work

Your public GitHub repos are your coding social media

Why version control?

Tracking others' work

As a social platform, you can see others' work too!

A **GitHub repo** contains all the files and folders for your project.

GitHub is a **remote host**. The files are geographically distant from any files on your computer.

Source: Shannon Ellis, *UC San Diego*

When you first make a copy onto your local computer (read: laptop), you **clone** the repository.

Source: Shannon Ellis, *UC San Diego*

If someone else on your project cloned the repo at the same time, you would have identical copies of the project on each of your computers.

Source: Shannon Ellis, *UC San Diego*

Yay! Everyone can work on the project!

Source: Shannon Ellis, *UC San Diego*

You decide you want to change a few of the images in the project.

Source: Shannon Ellis, *UC San Diego*

Source: Shannon Ellis, *UC San Diego*

without git...you'd likely rename these files....

Source: Shannon Ellis, *UC San Diego*

Thank goodness those days are over!

Source: Shannon Ellis, *UC San Diego*

Instead, you tell git which files you'd like to keep track of using **add**. This process is called *staging*.

Source: Shannon Ellis, *UC San Diego*

Then, you create a snapshot of your files at this point. This snapshot is called a **commit**.

Source: Shannon Ellis, *UC San Diego*

Source: Shannon Ellis, *UC San Diego*

You can make commits more informative by adding a **commit message**.

Example: `git commit -m "changed colors for animal icons"`

Then, you create a snapshot of your files at this point. This snapshot is called a **commit**.

A **commit** tracks who, what, and when

Source: Shannon Ellis, *UC San Diego*

Source: Shannon Ellis, *UC San Diego*

Source: Shannon Ellis, *UC San Diego*

Source: Shannon Ellis, *UC San Diego*

To catch up, your teammate will have to **pull** the changes from GitHub (remote)

Source: Shannon Ellis, *UC San Diego*

Source: Shannon Ellis, *UC San Diego*

Source: Shannon Ellis, *UC San Diego*

Let's recap real quick!

repo - set of files and folders for a project
remote - where the repo lives
clone - get the repo from the remote for the first time
add - specify which files you want to stage (add to repo)
commit - snapshot of your files at a point in time
pull - get new commits to the repo from the remote
push - send your new commits to the remote

Source: Shannon Ellis, *UC San Diego*

Each time you create a commit, git tracks the changes made automatically.

Source: Shannon Ellis, *UC San Diego*

By committing each time you make changes, git allows you to time travel!

Source: Shannon Ellis, *UC San Diego*

By committing each time you make changes, git allows you to time travel!

377dfcd00dd057542b112cf13be6cf1380b292ad

439301fe69e8f875c049ad0718386516b4878e22

456722223e9f9e0ee0a92917ba80163028d89251

There's a unique id, known as a **hash**, associated with each commit.

Source: Shannon Ellis, *UC San Diego*

You can return to the state of the repository at any commit. Future commits don't disappear. They just aren't visible when you **check out** an older commit.

Source: Shannon Ellis, *UC San Diego*

But...not everything is always linear. Sometimes you want to try something out and you're not sure it's going to work. This is where you'll want to use a **branch**.

Source: Shannon Ellis, *UC San Diego*

It's a good way to experiment. It's pretty easy to get rid of a branch later on should you not want to include the commits on that branch.

Source: Shannon Ellis, *UC San Diego*

But...what if you DO want to include the changes you've made on your **try-something-cool** branch into the **master** branch?

Source: Shannon Ellis, *UC San Diego*

Source: Shannon Ellis, *UC San Diego*

What if someone else is working on something cool and you want to play around with it? You'll have to **fork** their repo.

Source: Shannon Ellis, *UC San Diego*

After you fork their repo, you can play around with it however you want, using the workflow we've already discussed.

Source: Shannon Ellis, *UC San Diego*

But what if you think you've found a bug in their code, a typo, or want to add a new feature to their software? For this, you'll submit a **pull request** (aka **PR**).

Source: Shannon Ellis, *UC San Diego*

But what if you think you've found a bug in their code, a typo, or want to add a new feature to their software? For this, you'll submit a **pull request** (aka **PR**).

Source: Shannon Ellis, *UC San Diego*

someone else's repo

Last but not least...what if you find a bug in someone else's code OR you want to make a suggestion but aren't going to submit a suggestion with a PR. For this, you can file an **issue** on GitHub.

Source: Shannon Ellis, *UC San Diego*

someone else's repo

Last but not least...what if you find a bug in someone else's code OR you want to make a suggestion but aren't going to submit a suggestion with a PR. For this, you can file an **issue** on GitHub.

Issues are *bug trackers*. While, they can include bugs, they can also include feature requests, to-dos, whatever you want, really!

They can be assigned to people.

They can be closed once addressed ....or if the software maintainer doesn't like the suggestion

Source: Shannon Ellis, *UC San Diego*

One more git recap...

Source: Shannon Ellis, *UC San Diego*

One more git recap...

Source: Shannon Ellis, *UC San Diego*

One more git recap...

Source: Shannon Ellis, *UC San Diego*

You can work on others' repos by first **forking** their repository onto your GitHub

Pull requests allow you to make specific edits to others' repos

Issues allow you to make general suggestions to your/others' repos

One more git recap...

Source: Shannon Ellis, *UC San Diego*