

Theories

Date/Time	Name	Message
06/01/2020 09:22:50	FATIMA EZZAHRAA EL IDRISSE	Hi everyone
06/01/2020 09:03:55	Dr Karthik Krishnamurthy	hi everyone
06/01/2020 08:25:11	Grace Peng	For those of you who I haven't talked with me recently, I recommend you consider using the IMAG/MSM (CPMS) developed Ten Simple Rules for Credible Practice in Model design and development process to continuously increase the credibility (and reduce the skepticism) in your models, https://www.imagwiki.nibib.nih.gov/content/10-simple-rules-conformance-rubric
06/01/2020 08:20:53	Dr. Rick Gerkin	A pretty good fraction of the models in Model-DB are also in NeuroML-DB, but some are sort of hopeless because they consist of random MATLAB code from 15 years ago. Model-DB has many uses but many of its models will always be a blackbox; models expressed/converted to a machine-readable format that can track provenance (e.g. NeuroML but other alternatives as well) is probably required to solve this
06/01/2020 08:19:59	Grace Peng	Yes - everyone keep sending in your thoughts and links to resources - this conversation will be archived for deep analysis and synthesis!
06/01/2020 08:17:02	Dr. Fidel Santamaria	@Rick, yes, I think it would be a nice thing to try to create a provenance of the models in modelDB.
06/01/2020 08:13:08	Dr. Antonio Coronel	@Fidel, that is true.
06/01/2020 08:13:05	Dr. Rick Gerkin	@Fidel Provenance is hard in general but for some domains the pieces of models and their reuse in subsequent models can be well-tracked, e.g. for NeuroML and NeuroML-DB, and then tested against common perturbations.
06/01/2020 08:13:01	Dr. Il Memming Park	@Fidel hopefully if we use good metrics (multiple) then we can quickly sort out the not-so-useful models in that database. I think that would be wonderful to have.
06/01/2020 08:11:26	Dr. Fidel Santamaria	@Memming, I agree that this way there will be progress, but without a way of keep provenance of the models then we will just end up with a huge database of databases.
06/01/2020 08:08:54	Dr. Fidel Santamaria	@Rick, something that we argued in a series of papers is the lack of provenance in neuroscience modeling. I think it would be nice to have a way to track the 'evolution' of models, the data produced by them, and how the hypothesis in which they are being built are changing.
06/01/2020 08:08:20	Dr. Il Memming Park	In terms of model validation, I think open competitions and standard benchmarks can help.
06/01/2020 08:07:20	Dr. Antonio Coronel	@Rick, model validation it's a good area of opportunity to be improved. While many works only use a specific model, I think the validation of the model always have to be considering, as you said by comparing with others models or with real data.
06/01/2020 08:03:44	Dr. Rick Gerkin	The biggest roadblock to integrating competing theories is model validation testing. I receive multiple review requests every month for manuscripts on a certain topic, and 99% of the time those manuscripts do not present comparison to previous models beyond some crude benchmark model that no one actually uses. I am usually left with no idea whether the proposed model has shown any practical gain.
06/01/2020 08:03:23	Dr. Antonio Coronel	@Memming very interesting, I think models always have to be the abstract representation of systems and data, no matter how complex or simple they are. But I'm agree with you about the flexible and simple models.
06/01/2020 08:00:30	John LaMuth	the human cortical parcellation schemes of Brodmann (1909) and von Economo (1929) correlate topographically on essentially a one-to-one basis with the theoretically-derived dual parameter grid. Each cortical area described by Brodmann and von Economo corresponds (in hindsight) to schematically unique age/input coordinates, denoting a precise location within the dual parameter grid forebrain.org
06/01/2020 07:57:40	Dr. Il Memming Park	...may blind us from some dynamical features.

06/01/2020 07:57:06	Dr. Il Memming Park	@Stephanie, Rick: For modeling dynamics in neural data, the flexibility of the model is often quantified by the number of effective parameters and dimensionality. I am in favor of very flexible less mechanistic models at the moment, and they typically have a lot of parameters even for low-dimensions. Using a parametric form of dynamics presumes a certain computational architecture which...
06/01/2020 07:55:42	Dr. Fidel Santamaria	@Tatyana, I think this type of approach has been successfully used in whole cell metabolism analysis.
06/01/2020 07:54:09	Dr. Tatyana Sharpee	@Grace, @Fidel, on the topic of reducing heterogeneity, I think one can understand heterogeneity as a consequence of the need to maximize information. In other words, information maximization makes it possible to find circuit elements that are working together and which therefore can be coarse-grained described as one unit encoding one particular variable.
06/01/2020 07:51:55	Dr. Il Memming Park	Of course. In the right context, Jakob's method is super useful.
06/01/2020 07:50:54	Prof Stephanie Jones	I think the challenge is not in the number of parameters that the method can handle but in our interpretation of the multidimensional results as the neural models get more complicated
06/01/2020 07:50:31	Dr. Rick Gerkin	@Memming but if the goal of that work is to identify parameters of a mechanistic model (~100 or fewer), not to identify the parameters of an ML model, does it matter that ML models may have millions of parameters?
06/01/2020 07:48:12	Dr. Il Memming Park	@Rick true. but with ML typically using millions of parameters these days, it's hard to apply.
06/01/2020 07:47:02	Dr. Friedrich Sommer	Shaul, see you later
06/01/2020 07:46:44	Dr. Rick Gerkin	@Memming I can do a lot with 100!
06/01/2020 07:46:39	Dr. Friedrich Sommer	@Gautam: Agree, we need a culture change in neuroscience that gets the experiment theory cycle going: theory makes prediction -> experiment test tests predictions -> better theory makes prediction -> ...
06/01/2020 07:46:28	Dr. Il Memming Park	less than 100 range in this case?
06/01/2020 07:46:19	Dr. Fidel Santamaria	@Shaul, nice conversation! Take care.
06/01/2020 07:46:12	Dr. Rick Gerkin	@Stephanie @Memming How large is moderate?
06/01/2020 07:45:55	Dr. Il Memming Park	@Prof Stephanie Jones Thanks, but that particular method only works for models with moderate number of parameters, if I understood correctly.
06/01/2020 07:45:40	Dr. Shaul Druckmann	I have to run unfortunately. Lots of great papers added to my reading list! Thank you very much everyone!
06/01/2020 07:44:21	Prof Stephanie Jones	There are some exciting frameworks combining machine learning methods and dynamical modeling methods that I think will help with some of the roadblocks in bridging theories between different scales of modeling - https://www.biorxiv.org/content/10.1101/838383v1
06/01/2020 07:43:40	Dr. Shaul Druckmann	I agree that compositionality is very important, interesting and a big subject
06/01/2020 07:43:34	Dr. Fidel Santamaria	@Linus, I think there are still several efforts of creating an observer-free behavior, but it is evolving.
06/01/2020 07:42:57	Dr. Shaul Druckmann	@Rick I don't know of anything new in the single neuron space (haven't been following it closely recently) but would love to hear if you find.
06/01/2020 07:41:59	Dr. Fidel Santamaria	@Grace, do you know if we're going to be able to save the conversation? Otherwise, I have to start downloading all the cool papers being discussed.
06/01/2020 07:40:45	Dr. Rick Gerkin	@Shaul single neurons is a good place to start
06/01/2020 07:40:24	Prof Stephanie Jones	Hi All - just catching up to speed on some of the chat.. in regard to comparing human and animal behavior and data, we have some evidence that when comparing macrocale signals that rely on conserved features of cortical circuitry signals and their modulation with behavior are comparable across species PMID: 29106374 & PMID: 27469163

06/01/2020 07:40:24	Dr. Friedrich Sommer	It was mentioned by Xaq this morning
06/01/2020 07:40:14	Dr. Gautam Agarwal	On the topic of theory integration, it seems like we are generally incentivised (in publications, grants, and professionally) to specify the uniqueness of our contributions, which is at odds with an integrative drive. Perhaps integration is being achieved more in e.g. physics and genomics where individual contributions to large-scale consortia have currency.
06/01/2020 07:40:03	Dr. Antonio Coronel	From the point of view of the engineering, model-based design allows to have a good interpretation of the system, but some times when we need to characterize a particular system we used to use system identification, which is a tool that can modeling by using only data.
06/01/2020 07:39:46	Dr. Shaul Druckmann	@Rick for single neurons in particular or in general?
06/01/2020 07:39:45	Dr. Friedrich Sommer	I think another roadblock barring us from better theories is that we are not thinking enough about how compositionality can be neurally encoded.
06/01/2020 07:39:28	Linus Manubens-Gil	@Fidel thank you, I agree, once observer-free-phenotypes are well defined those will allow also to explore evolution. Is there any roadmap towards the definition of such behavioral phenotypes? How can a "complete" behavioral phenotyping strategy be defined?
06/01/2020 07:39:18	Dr. Rick Gerkin	@Fidel @Antonio I've recently began trying to build a good bibliography about this kind of work (model-based experimental design, especially for intracellular recordings), but I'm pretty sure I'm missing some key contributions. I have various papers from Druckmann, Zhang, Paninski; do you know what else is out there? Also @Shaul, presumably you would know!
06/01/2020 07:38:45	Dr. Shaul Druckmann	@Fritz: "Spike timing codes on it own is brittle but the combination of spike timing and rhythms works well". Elegant way to put it!! I'll remember that one. Will definitely look at the paper
06/01/2020 07:37:45	Dr. Friedrich Sommer	https://www.pnas.org/content/116/36/18050
06/01/2020 07:37:05	Dr. Friedrich Sommer	Our final paper about spike timing and rhythms is here:
06/01/2020 07:36:08	Dr. Antonio Coronel	@Rick, I'm agree with you.
06/01/2020 07:35:53	Dr. Fidel Santamaria	@Rick, totatlly agree with you.
06/01/2020 07:35:21	Dr. Rick Gerkin	@Grace I think model-based design of experimental protocols can help to reduce variability (and improve information content) of experiments. For example, people still inject square waves into patch-clamped neurons to characterize them. But a model-based design would recommend more reliable and informative approaches.
06/01/2020 07:35:17	Dr. Fidel Santamaria	@Grace, to reduce heterogeneity I think there is so much to be done. I don't kow if with AI. FOr exmaple, once I tried to get money (failed) to build a system to fully automate the collection of brain slices for patch clamp, up to temperature and pressure. Electrophys is still a labor intensive process that requires automation.
06/01/2020 07:35:06	Dr. Friedrich Sommer	@Memming: Yes, this is an example, if you want to compute anything with recurrent spiking neural networks, just rate code isnt a good proposal. Spike timing codes on it own is brittle but the combination of spike timing and rhythms works well
06/01/2020 07:33:49	Dr. Shaul Druckmann	Hi Fritz! I totally agree that neuromorphic computing can/should be a great influence and would love to see it more!
06/01/2020 07:33:27	Dr. Il Memming Park	@Friedrich I enjoyed your work on rhythmic neurons https://arxiv.org/abs/1901.07718
06/01/2020 07:33:26	Dr. Fidel Santamaria	@Luke, I think there should be an increase emphasize in putting organization, optimization, and function under the umbrella of evolution rather than purely engineering principles.
06/01/2020 07:32:26	Dr. Fidel Santamaria	@Luke, that's an excelent question. I think there are very few of them. I think this is the updated work from Laughlin https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1000840
06/01/2020 07:31:52	Dr. Friedrich Sommer	Hi everyone! I think for coming up with better neuroscience theories, not only machine learning/AI but neuromorphic computing is coming back as an influential source (it was somewhat gone for two decades..).

06/01/2020 07:31:47	Dr. Il Memming Park	@Shaul no preprint for the science part yet. Several methods papers under review: https://arxiv.org/abs/1906.01549
06/01/2020 07:30:52	Dr. Antonio Coronel	Ir our poster (TDA12) we find that by using fractional calculus, we can predict fast changes in the system's dynamics.
06/01/2020 07:30:39	Dr. Shaul Druckmann	@Memming, mesoscopic dynamical systems models sounds super interesting and relevant. Is there a preprint to read?
06/01/2020 07:29:59	Dr. Il Memming Park	@Shaul thanks. I've been focusing more on mesoscopic dynamical system models. I'm no longer working on the Allen Brain Observatory dataset, unfortunately.
06/01/2020 07:29:57	Luke Stoeckel	very interesting. are there any good papers you could recommend that address evolutionary constraints on behavior w/ implications for the study of brain-behavior relationships across different animal species at different scales or space and time using the types of new technologies being developed in efforts like BRAIN?
06/01/2020 07:29:52	Grace Peng	On the topic of reducing heterogeneity (and uncertainty and error) - what do you all think about using AI to consistently control the instruments and protocols that are used to collect heterogeneous data across spatial and temporal scales, across brain regions, across species?
06/01/2020 07:29:14	Dr. Antonio Coronel	I'm agree with Fidel, most of the times we force to match our data to a particular model, for example a Markov processes, but we are losing important information. We can use non-Markov dynamics by using fractional calculus.
06/01/2020 07:27:20	Dr. Fidel Santamaria	 the evolutionary constraints, I think, are more applicable to behavior.
06/01/2020 07:26:57	Dr. Fidel Santamaria	So, the structure of neuroscience theories is also in pre-print form. I think the firing rate-spike timing paper is next. In the multi-scale paper we want to emphasize the importance of incorporating heterogeneity when moving from one scale to the other and imposing constraints to model generation that depend on energetics.
06/01/2020 07:26:47	Dr. Shaul Druckmann	@Il Memming: you have done some really cool inference work. Have you been thinking about coarse graining and multi-scale models? I read the eNeuro paper (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6071196/) and that seems relevant
06/01/2020 07:24:11	Linus Manubens-Gil	Dr. Santamaria, from the preprint you shared I was thinking about the 6 conclusions (questions) specified there. Could you briefly mention which ones have been advanced in the manuscripts that will be published soon and which ones are still to be developed? I am particularly interested in the multi-scale problem being mentioned and the development of the broader conceptual framework of Evolution
06/01/2020 07:23:45	Dr. Il Memming Park	@Patricia, I'll check it out.
06/01/2020 07:23:37	Dr. Fidel Santamaria	@Memming, Patricia has a poster in the TMM section. We have a collaboration with Maurice Chacron at McGill and we have replicated how the weakly electric fish processes natural stimuli using our electric circuit.
06/01/2020 07:23:27	FATIMA EZZAHRAA EL IDRISSI	hello
06/01/2020 07:23:17	MSc Patricia Vazquez	@Dr. Il Memming Park yes, we are working with supercapacitors, you can see it in our poster TDA75, we want to compare our model to match it with real neurons and reproduce some behaviors and illnesses
06/01/2020 07:22:10	Dr. Michele Ferrante	https://princetonuniversity.github.io/PsyNeuLink/
06/01/2020 07:21:20	Dr. Michele Ferrante	PsyNeuLink from Jonathan Cohen seems to provide an environment to put models across different scales in the same space for them to interact
06/01/2020 07:20:31	Dr. Shaul Druckmann	Fidel, I completely agree. I think now that large-scale recordings are more common, one can ask really interesting questions about how to coarse-grain the data. Kanaka's talk today was a really interesting example of that for instance
06/01/2020 07:18:36	Dr. Fidel Santamaria	@Shaul, no hurry, I'm in the same boat.

06/01/2020 07:17:58	Dr. Fidel Santamaria	Grace, I think is about scales of integration. One discussion we had last year about multi-scale modeling was how to integrate the 'other' scales that are outside your main focus. Traditionally, people use mean field or some other approach that homogenizes the rest of the system. However, we need a way to integrate heterogeneity.
06/01/2020 07:17:55	Dr. Il Memming Park	@Patricia A fully analog circuit? What kind of real-time applications do you have in mind?
06/01/2020 07:17:23	Dr. Shaul Druckmann	@Fidel, definitely will do but with the shelter-in-place lack of daycare it might take me a couple of days to get to it
06/01/2020 07:16:43	MSc Patricia Vazquez	Hello, I am working also in Dr. Santamarias lab, we implemented a non linear hodgkin-huxley equations in a circuit that permit us to work in real time
06/01/2020 07:15:48	Dr. Fidel Santamaria	Shaul, let me know what you think about the paper.
06/01/2020 07:15:34	Grace Peng	The question is how do we integrate existing theories - to achieve the ultimate goal of understanding how the brain works? How do we develop bigger theories of the brain?
06/01/2020 07:15:03	Dr. Antonio Coronel	Many novel results take a long time to be proved, but if we find a new path to do it most of the times people are not agree with the new methods. I think we need to be more critics in the good way.
06/01/2020 07:13:58	Dr. Fidel Santamaria	Tatyana, while I agree in principle I think a roadblock can be self-imposed. For example, if we keep treating neurons and animals as Markov-chain processes, when there is evidence they are not, then we will continue building experiments to reduce their behavior to match our models. While this will validate the specific predictions, it might not provide predictive power when the animals are free.
06/01/2020 07:12:19	Dr. Antonio Coronel	You are right Shaul, patience is what should be considered
06/01/2020 07:11:22	Dr. Tatyana Sharpee	In my optimistic opinion, there are no real conceptual roadblocks to developing a good theory -- except time and effort. It takes a long time, potentially many years, to develop a good theory that can serve as a true framework for guiding and interpreting a broad range of experiments.
06/01/2020 07:11:18	Dr. Shaul Druckmann	Fidel, the white paper you posted (https://arxiv.org/abs/2004.01665) looks really interesting. I skimmed it but will definitely read it in detail later. Thank you for bringing it up!
06/01/2020 07:10:06	Dr. Fidel Santamaria	BTW, Antonio Coronel is a postdoc in my group. He can talk about the type of theoretical approaches we are using that I think are different from traditional work. We use non-Markovian dynamics that results in fractional order differential equations. We have 2 posters about this.
06/01/2020 07:10:00	Dr. Daniela Monje Reyna	in other hand about what Dr. Santamaria said, of the observer's limitation, I agree in sense that the most relevant for the living system could be other thing than the behavioral expression that the observer choose.
06/01/2020 07:09:26	Dr. Daniela Monje Reyna	..indeed it is a challenge for engineers work with a nonlinear approach, but I think once one realize of the reach of a nonlinear model using theories as history dependence, it is very encouraging.
06/01/2020 07:08:38	Dr. Antonio Coronel	In particular we are working with fractional calculus applied in neuroscience to model complex activity in the brain.
06/01/2020 07:08:28	Dr. Fidel Santamaria	Shaul, I think the two-alternative-forced-choice was something that the participants in my workshop found quite interesting. There were discussion about making the alternative choices between two natural behaviors, for example.
06/01/2020 07:08:22	Dr. Shaul Druckmann	I totally agree Antonio. In my (limited) experience it can take years to develop a new theory, then years to do the hard work to see if it can be cast in a way that generates an experimental prediction that is doable with current technology. If the field doesn't have patience for this time frame and demands instant verifiable predictions that can stifle novel work
06/01/2020 07:06:27	Dr. Antonio Coronel	Hello everyone, I think one roadblock could be not accepting or be skeptical with new theories in development.
06/01/2020 07:05:58	Dr. Shaul Druckmann	Fidel, how do you feel about data from automated training to perform simple tasks like two-alternative-forced-choice? Interesting? Or do you want more free behavior?
06/01/2020 07:05:07	Dr. Michele Ferrante	ok, we are talking about the same thing.

06/01/2020 07:05:05	Dr. Shaul Druckmann	http://pillowlab.princeton.edu/pubs/abs_Roy_NeurIPS18.html
06/01/2020 07:04:33	Dr. Shaul Druckmann	This is the Pillow paper I mentioned:
06/01/2020 07:04:07	Dr. Fidel Santamaria	Michele, the first version, definitely. Data-driven, unbiased, and so on.
06/01/2020 07:03:45	Grace Peng	Great to learn about new tools, workshops and materials to better generate and integrate theories - please continue to include relevant links in the chat!
06/01/2020 07:03:01	Dr. Michele Ferrante	I guess I was curious if when you say observer-free-phenotype, you mean unbiased, data-driven, computer-generated or you mean like in quantum physics that you remove the observer and the behavior changes because the system is not observed by a 3rd party....
06/01/2020 07:02:47	Dr. Shaul Druckmann	I would be super interested to hear people's opinion of work in other fields to draw insight from
06/01/2020 07:02:16	Dr. Shaul Druckmann	Back on the subject of understanding recurrent, distributed computation, I also really liked Joe Monaco's direction in trying to connect to swarm robotics. Getting insight from other fields has been really successful for neuroscience in the past, and distributed computation is relevant to lots of fields: gene networks, animal population dynamics, ecology, CS parallel computing.
06/01/2020 06:57:33	John LaMuth	hy not consider my revolutionary periodic table for the human neurosciences (HN32) that enjoys similar advantages to the dramatic influence that the Periodic Table of the Elements has enjoyed with respect to Chemistry and Physics . The radical expansion of the neocortex is observed to occur in a discrete pattern suggestively termed cortical growth rings as a Cartesian coordinate system
06/01/2020 06:57:11	Dr. Fidel Santamaria	Michele, I would word it as an observer-free-phenotype. We need to develop observer independent definitions of behavior, so we can actually then ask if a behavior in one organism is reproducible in another.
06/01/2020 06:56:26	Dr. Shaul Druckmann	Jonathan Pillow has some really nice papers about modeling behavior and training
06/01/2020 06:55:25	Dr. Fidel Santamaria	This push to have full motion caption could be interesting to then decompose behavior. However, this is a very tough problem. I wonder how this is done in consumer economics, which is pretty good at predicting some behaviors without having to have the involved animals in a reduced environemnt.
06/01/2020 06:54:55	Dr. Michele Ferrante	fidel you are talking about things like deeplabcut and moseq as "augmented" scientists
06/01/2020 06:54:01	Dr. Shaul Druckmann	Totally agree!
06/01/2020 06:53:40	Dr. Fidel Santamaria	I think a fundamental issue is to have non-observer deffinitions of behavior. It is still a phenotype defined by the experimenter. We don't know if what we're evaluating is what is actually the most relevant for the animal.
06/01/2020 06:52:39	Dr. Shaul Druckmann	Also, more diverse model systems, like Dimitriy Aronov looking into caching in chickadees
06/01/2020 06:51:42	Dr. Shaul Druckmann	Also some labs like Alla Karpova have been able to teach rats pretty complex behaviors. I think the limits are unknown, but from a theory perspective I would love to see more investment in this.
06/01/2020 06:50:59	Dr. Shaul Druckmann	The trend towards automated training of animals might help make that more tractable.
06/01/2020 06:50:31	Dr. Shaul Druckmann	I think also a push in research on how complicated of a task can you actually teach a given animal, and how to do that in practice would be super useful
06/01/2020 06:49:17	Dr. Michele Ferrante	So we need "smarter" animals able to be trained in more complex (translationally relevant) behaviors or we need to be able to describe behavior better in simpler animals? The answer is always both...
06/01/2020 06:48:35	Dr. Shaul Druckmann	Another, just to have something up there: I think the dynamics of neural circuits are in a particularly difficult regime for both intuition, applied math and engineering.I find it super difficult to have a mental model of interactions in dynamical systems with more than a handful of elements. Applied math of recurrent non-linear systems is challenging, and engineers often don't work in this regime
06/01/2020 06:47:49	Dr. Fidel Santamaria	Shaul, I think a subgroup had a discussion related to what you state about the type of experiments we currently perform.

06/01/2020 06:46:10	Dr. Fidel Santamaria	The idea of the workshops was to think about the future frameworks of theoretical neuroscience. I expect we will produce at least 2 more papers, they have been slower than expected. But we'll get there.
06/01/2020 06:45:02	Dr. Fidel Santamaria	Here are the papers if you guys are interested. https://arxiv.org/abs/2004.01665 https://arxiv.org/abs/2003.13825
06/01/2020 06:44:40	Dr. Shaul Druckmann	Awesome! Could I ask for the link?
06/01/2020 06:44:20	Dr. Fidel Santamaria	We tried to address this in an NSF supported workshop I co-organized last year. We have, so far, two pre-prints that came out of this discussions
06/01/2020 06:43:59	Dr. Shaul Druckmann	Hi!
06/01/2020 06:43:52	Dr. Shaul Druckmann	I think there are a bunch, but just to get the ball rolling: it is really hard to train animals to do complex tasks but simple tasks often don't yield strong constraints on network dynamics since they can be solved with a handful of neurons and not the tens of thousands in a rodent circuit for instance
06/01/2020 06:42:50	Dr. Michele Ferrante	Hi Shaul!