Prospective PhD — Topographic & Plasticity-Aware Models of Primate Vision (TDANN × Continuous-Time Learning)

Dear Professor DiCarlo,

Hope this email finds you well!

My name is Yuting Fang (Student ID: 5518340). I am currently completing a Bachelor of Mathematics & Statistics (Honours) at UNSW Sydney, supervised by Professor Quoc Le Gia (School of Maths&Stats) and Professor Flora Salim(School of Computer Science and Engineering). My thesis centers on Neural Stochastic Differential Equations (Neural SDEs) for continuous-time dynamics, with applications to irregularly sampled medical and neuroimaging time series. I’m aiming to pursue a computational neuroscience PhD (2026 entry) and would be honoured to explore opportunities in your group.

I was energized by your recent work on topographic deep ANN models (TDANN) that predict functional organization across multiple ventral-stream areas, offering a unified account of cortical maps and even enabling causal-perturbation predictions; and by your new results showing that object category training induces IT population changes consistent with performance-optimizing updates within a visual hierarchy. Together, they sketch a compelling theory of how structure (topography) and experience-dependent plasticity shape primate vision. If you are recruiting PhD students, I’d love to contribute along two directions that build directly on these papers:

1. TDANN-SDE: adding time to topography  
   Extend TDANN with a continuous-time latent dynamics layer (Neural SDE) to jointly model spatial topography and temporal response trajectories from V1→IT. The aim is to predict not just where functional maps emerge, but when/how category-selective responses unfold and stabilize—yielding time-resolved brain–model alignment and causal intervention forecasts (e.g., microstimulation/site-specific inactivation timing). Benchmarks: fit macaque MEG/LFP/MUA dynamics and evaluate map fidelity + temporal generalization; test TDANN-SDE against the causal-perturbation prediction regime you outlined for topographic models. Continuous-time plasticity that optimizes recognition performance  
   Formalize the “performance-optimizing updates” observed after category training as a hierarchical SDE plasticity model acting on mid/late ventral layers (drift = synaptic/feature updates; diffusion = exploration/noise). The model would generate falsifiable predictions about: (i) which layers/retinotopic zones adapt first under particular image curricula, (ii) the time constants of IT tuning shifts, and (iii) how training schedules alter behavioral learning curves. We can validate against your macaque IT training data and quantify gains with Brain-Score style metrics before/after controlled experience.

My background equips me to contribute effectively to these directions: I have a strong foundation in mathematics and statistics, hands-on experience with Neural SDE implementation and time-series inference, and a track record of applying rigorous evaluation methods—including held-out prediction, counterfactual validation, and calibrated uncertainty analysis. Beyond technical skills, I bring genuine enthusiasm for developing high-quality, falsifiable models that are tightly integrated with experimental design and validation.

I am confident that my proficiency in PyTorch, torchsde/torchdyn, probabilistic modeling, and data analysis (including tools like Suite2p and CaImAn) will allow me to make meaningful contributions to these research topics. Additionally, I have completed two foundational psychology courses, which provide a solid basis for experimental design and the interpretation of behavioral data.

I would be very grateful for the opportunity to discuss potential PhD projects with you—whether as a thesis student, visiting researcher, or intern. I am happy to arrange an online discussion via any online platform at your convenience, and I can also share my CV, academic transcript, and a detailed research outline beforehand for your reference.

Thank you for your time and consideration. I greatly admire the interdisciplinary rigor of your lab and would be honored to contribute to your research.

Warm regards,  
Yuting Fang

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