GVLAB Seminar

Prof. Jean-Jacques Slotine
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Stable adaptation and learning

While we may soon have AI-based artists or scientists, we are nowhere near autonomous robot plumbers. The human brain still largely outperforms robotic algorithms in most tasks, using computational elements 7 orders of magnitude slower than their artificial counterparts. Similarly, current large scale machine learning algorithms require millions of examples and close proximity to power plants, compared to the brain's few examples and 20W consumption. We study how modern nonlinear systems tools, such as contraction analysis, virtual dynamical systems, and adaptive nonlinear control can yield quantifiable insights about collective computation and learning in large physical systems and dynamical networks. For instance, we show how stable implicit sparse regularization can be exploited online in adaptive prediction or control to select relevant dynamic models out of plausible physically-based candidates, and how most elementary results on gradient descent and optimization based on convexity can be replaced by much more general results based on Riemannian contraction.

Time permitting, we will discuss a new approach to dense associative memories and transformers directly inspired by astrocyte biology. This may be the first contribution to AI of neuroscience results from the last 50 years.

Janurary 24th 2024
10:00-11:30
Hybrid: UT Hongo Campus
Eng. Bld 2 (3F) room 322

skype

Jean-Jacques Slotine is Professor of Mechanical Engineering and Information Sciences, Professor of Brain and Cognitive Sciences, and Director of the Nonlinear Systems Laboratory. He received his Ph.D. from the Massachusetts Institute of Technology in 1983, at age 23. After working at Bell Labs in the computer research department, he joined the faculty at MIT in 1984. Professor Slotine teaches and conducts research in the areas of dynamical systems, robotics, control theory, computational neuroscience, and systems biology. One of the most cited researchers in systems science, he was a member of the French National Science Council from 1997 to 2002, a member of Singapore's A*STAR SigN Advisory Board from 2007 to 2010, a Distinguished Faculty at Google AI from 2019 to 2023, and has been a member of the Scientific Advisory Board of the Italian Institute of Technology since 2010.

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