SYDE 556/750

Simulating Neurobiological Systems
Lecture 6: Recurrent Dynamics

Andreas Stöckel

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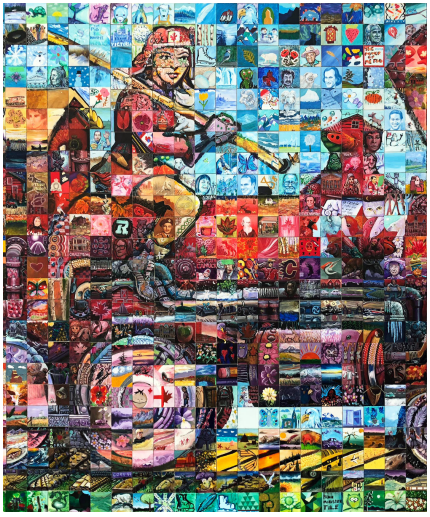

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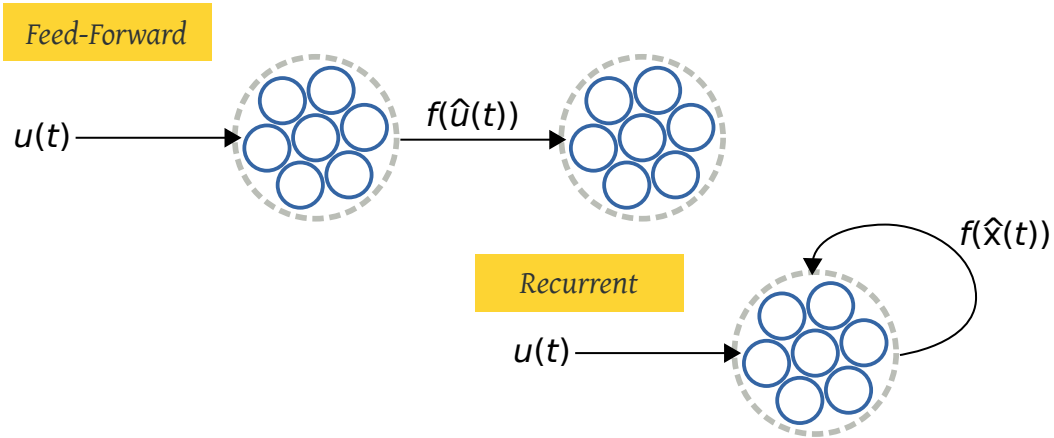
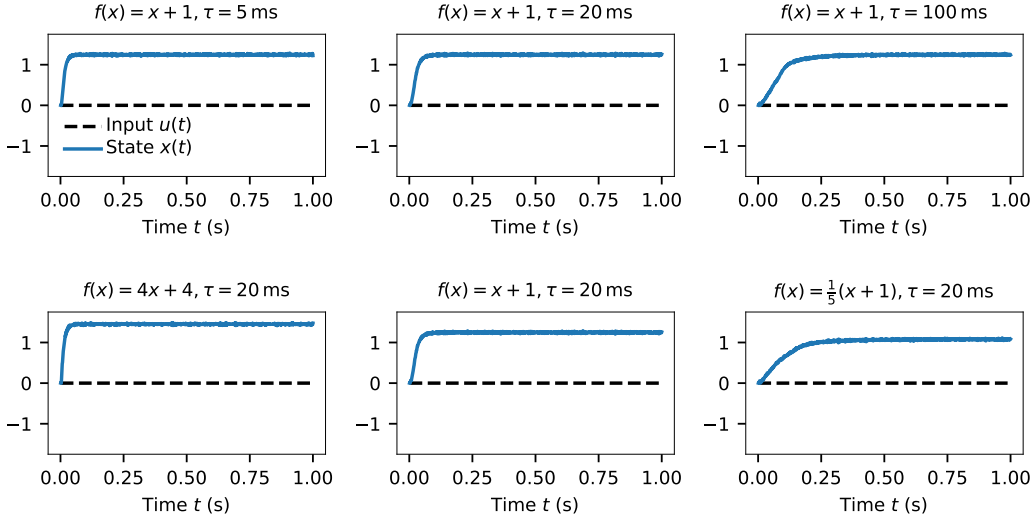
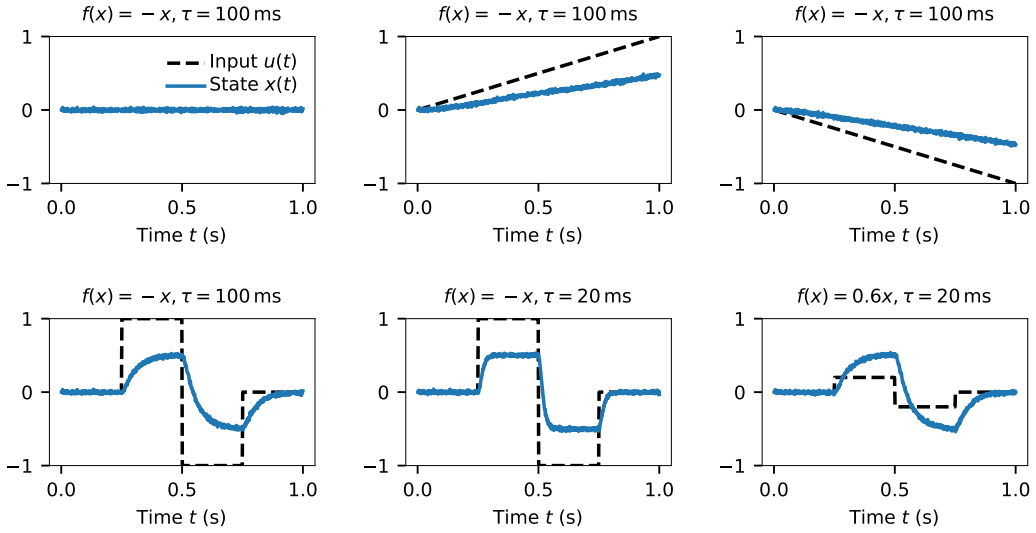
Feed Forward vs. Recurrent Connections



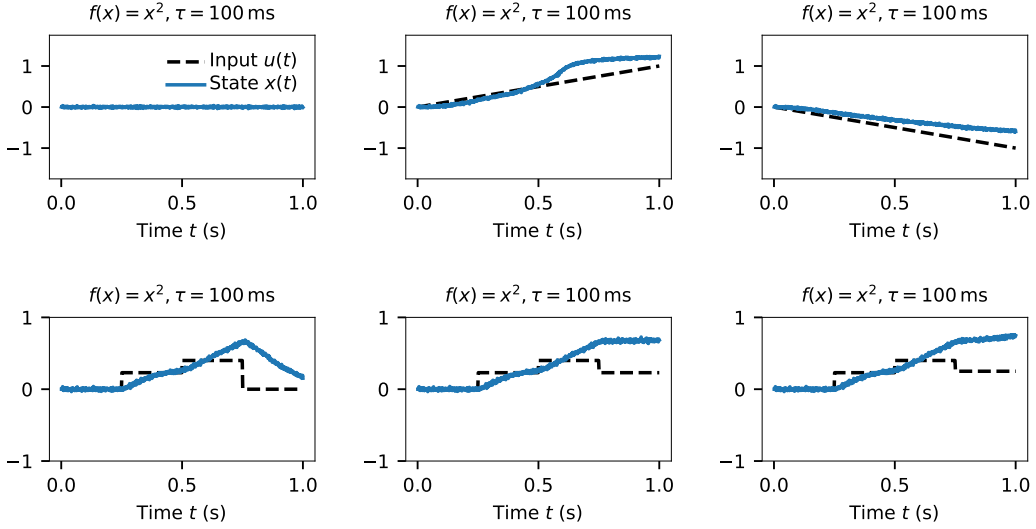
Recurrence Experiments (I)



Recurrence Experiments (II)



Recurrence Experiments (III)



NEF Principle 3: Dynamics

Time-Invariant Dynamical System

$$\frac{\mathrm{d}\mathbf{x}(t)}{\mathrm{t}} = f(\mathbf{x}(t), \mathbf{u}(t))$$

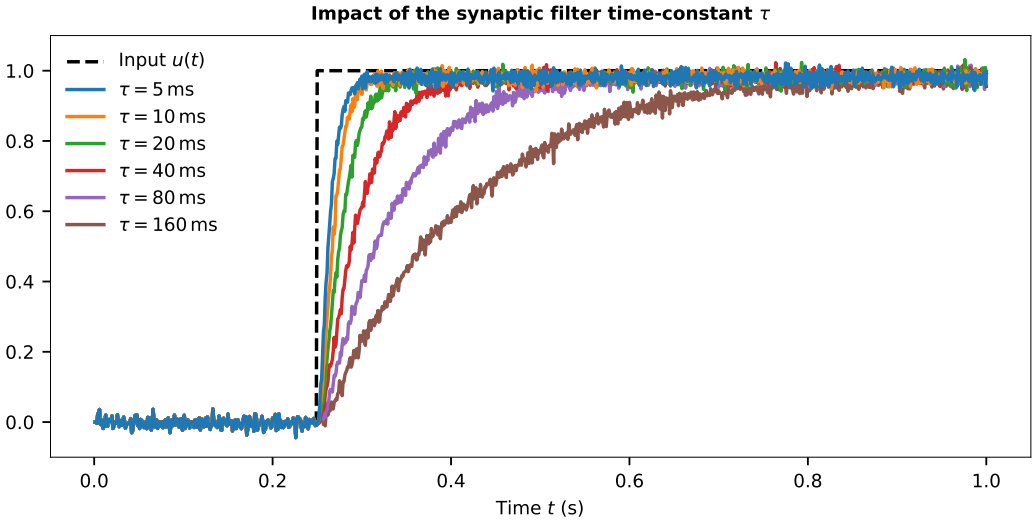
Linear Time-Invariant (LTI) Dynamical System

$$\frac{\mathrm{d}\mathbf{x}(t)}{\mathrm{t}} = \mathbf{A}\mathbf{x} + \mathbf{B}\mathbf{u}$$

NEF Principle 3 – Dynamics

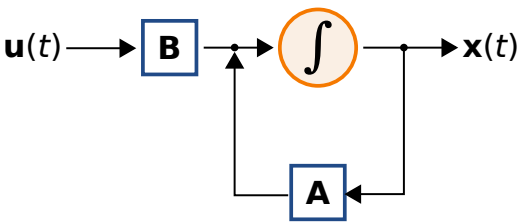
Neural dynamics are characterized by considering neural representations as control theoretic state variables. We can use control theory (and dynamical systems theory) to analyse and construct these systems.

Making Sense of Dynamics



Implementing Dynamics using a Neural Ensemble

Evaluating an LTI
using an Integrator



Evaluating an LTI
using a Synaptic Filter

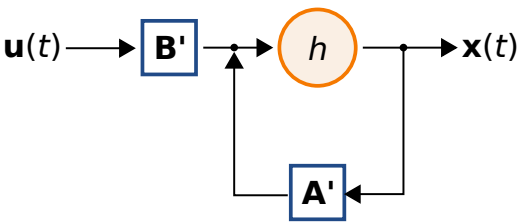


Image sources

Title slide
"The Canada 150 Mosaic Mural"
Author: Mosaic Canada Murals.
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