NEST Desktop

Simulation and AI with
Spiking Neural Networks made easy

Co-funded by
the European Union

EBRAINS

Human Brain Project

Universität Trier

A Network??

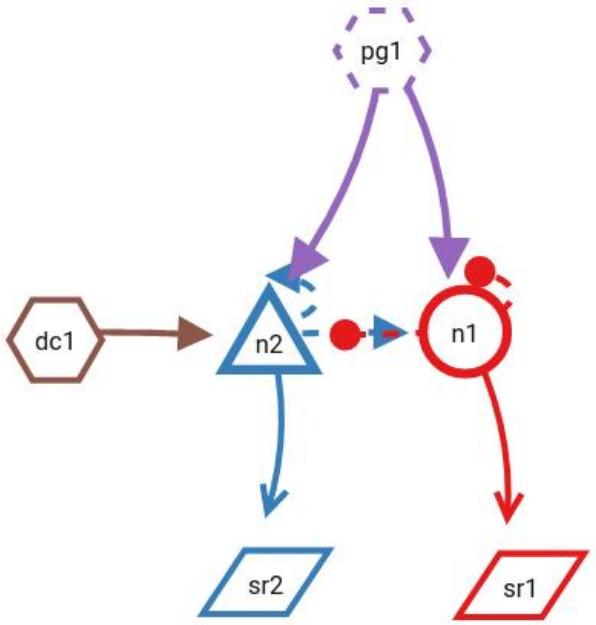
c6f9a0

```python
import nest
import numpy

nest.ResetKernel()

# Set simulation kernel
nest.SetKernelStatus({
  "local_num_threads": 1,
  "resolution": 0.1,
  "rng_seed": 1
})

# Create nodes
n1 = nest.Create("iaf_psc_alpha", 1, params={
  "I_e": -5,
}, positions=
  nest.spatial.free(
    nest.random.uniform(-0.5, 0.5),
    num_dimensions=3
  )
)
n2 = nest.Create("iaf_psc_alpha", 1, positions=
  nest.spatial.free(
    nest.random.uniform(-0.5, 0.5),
    num_dimensions=3
  )
)
sr1 = nest.Create("spike_recorder", 1)
sr2 = nest.Create("spike_recorder", 1)
pg1 = nest.Create("poisson_generator", 1, params={
  "rate": 135000,
})
dc1 = nest.Create("dc_generator", 1, params={
  "amplitude": -5,
  "start": 350,
  "stop": 650,
})

# Copy synapse models
nest.CopyModel("static_synapse", "excitatory", params={
  "weight": 2,
})
```

```python
nest.CopyModel("static_synapse", "inhibitory", params={
  "weight": -8,
})

# Connect nodes
nest.Connect(n2, n2, conn_spec={
  "rule": "pairwise_bernoulli",
  "p": 0.05,
}, syn_spec="excitatory")
nest.Connect(n2, n1, conn_spec={
  "rule": "pairwise_bernoulli",
  "p": 0.05,
}, syn_spec="excitatory")
nest.Connect(n1, n2, conn_spec={
  "rule": "pairwise_bernoulli",
  "p": 0.05,
}, syn_spec="inhibitory")
nest.Connect(n1, n1, conn_spec={
  "rule": "pairwise_bernoulli",
  "p": 0.05,
}, syn_spec="inhibitory")
nest.Connect(n2, sr2)
nest.Connect(n1, sr1)
nest.Connect(dc1, n2)
nest.Connect(pg1, n1, syn_spec={
  "weight": 0.5,
})
nest.Connect(pg1, n2, syn_spec={
  "weight": 0.5,
})

# Run simulation
nest.Simulate(1000)

# Get positions
def getPositions(nodes):
    positions = {}
    for node in nodes:
        position = nest.GetPosition(node)
        for idx in range(len(node)):
```

```python
            positions[node[idx].global_id] = position[idx]
    return positions

response = {
  "events": [sr1.events, sr2.events, ],
  "positions": getPositions([n1,n2,])
}

```

A Network!



ALL NEURON STIMULATOR RECORDER MODEL CUSTOM

PG1 POISSON GENERATOR

population size 1

mean firing rate (Hz) 135000

PG1 → N1

connection rule: all to all

synaptic weight (pA) 0.5

PG1 → N2

connection rule: all to all

synaptic weight (pA) 0.5

NEST Desktop – Intro

Intuitive front-end for simulations and visualizations

For simulation in neuroscience and AI (in progress)

Front-end app as a cloud service

Training courses

Licenses for course materials

Two Use Cases

1) SNNs for AI/Machine Learning (in progress)
2) SNNs for Simulation

1) SNNs for AI/Machine Learning – Problems

BBC

NEWS

Health

New superbug-killing antibiotic discovered using AI

4 days ago · Comments

BBC, 25.05.2023

AI Power Consumption Exploding

Exponential increase is not sustainable. But where is it all going?

AUGUST 15TH, 2022 - BY: **BRIAN BAILEY**

Semiconductor Engineering

New artificial intelligence tool can accurately identify cancer

Exclusive: algorithm performs more efficiently and effectively than current methods, according to a study

The Guardian, 30.04.2023

Artificial Intelligence Is Booming—So Is Its Carbon Footprint

Greater transparency on emissions could also bring more scrutiny

Bloomberg, 09.03.2023

1) SNNs for AI/Machine Learning – Solution

Spiking neural networks (SNN) offer high efficiency

Graphical model and network editing lowers the barrier massively

Course and training offers allow fast-track training

Using industry standards

Total deep learning market: €49.6 Billion in 2022

PyTorch Norse

2) SNNs for Simulation – Problem

Students in biology/neurobiology often have low programming skills

Visualizing models from source code is very difficult

Universities / Institutes often do not have enough resources to teach specialization courses for students / PhDs in this field

2) SNNs for Simulation – Solution

Intuitive Web UI service (cloud subscription)

Visual network editing → simulation without coding

Training course and course material licenses

Already in usage (Germany, Czech Republic)

Market: > 200 universities in EU alone

Call to Action

We are looking for 24 months financing to fully implement the AI integration and gather first customers for the simulation courses.

Contact

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