

# NeuraViz: A Web Application For Visualizing Artificial Neural Network Structures

Bennett Wendorf

University of Wisconsin - La Crosse

April 30, 2024

# NeuraViz

## What is NeuraViz?

- What is NeuraViz?

# NeuraViz

## What is NeuraViz?

- What is NeuraViz?
- Why NeuraViz?

# NeuraViz

## What is NeuraViz?

- What is NeuraViz?
- Why NeuraViz?

## Goals

- Breadth of supported models

# NeuraViz

## What is NeuraViz?

- What is NeuraViz?
- Why NeuraViz?

## Goals

- Breadth of supported models
- Ease of use

# NeuraViz

## What is NeuraViz?

- What is NeuraViz?
- Why NeuraViz?

## Goals

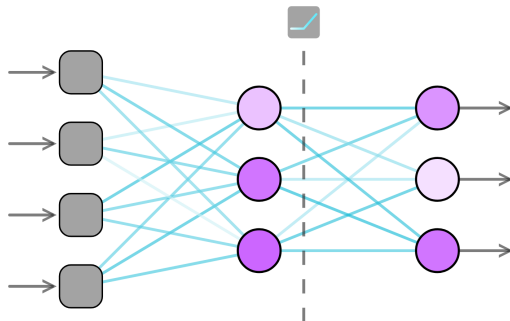
- Breadth of supported models
- Ease of use
- Portability

# Artificial Neural Networks

What is an artificial neural network?

# Artificial Neural Networks

What is an artificial neural network?





# Life Cycle Model

## Models

- Waterfall

# Life Cycle Model

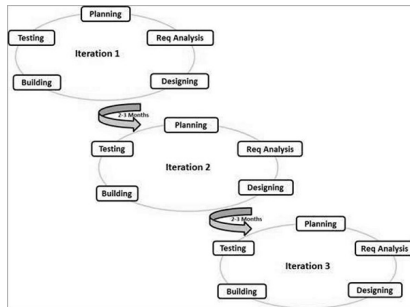
## Models

- Waterfall
- Iterative

# Life Cycle Model

## Models

- Waterfall
- Iterative
- Agile (Scrum)



# Scrum Tweaks

- **Sprint Length:**

# Scrum Tweaks

- **Sprint Length:** 1 week

# Scrum Tweaks

- **Sprint Length:** 1 week
- **Standups:**

# Scrum Tweaks

- **Sprint Length:** 1 week
- **Standups:** weekly

# Scrum Tweaks

- **Sprint Length:** 1 week
- **Standups:** weekly
- **Retrospectives:**



# Scrum Tweaks

- **Sprint Length:** 1 week
- **Standups:** weekly
- **Retrospectives:** integrated into standups

# Process Technologies

Projects / NeuraViz / Scrum

## Sprint 25

9 days remaining



Complete sprint



Add people

Quick filters ▾

GROUP BY

Stories ▾

Insights

View settings

### BACKLOG 1

#### Add glossary

0%

☒ NRVZ-63

+ Create issue

### PROGRAMMING 2

#### Add documentation/help page/landing page

50%

☒ NRVZ-53

#### Make revisions

25%

☒ NRVZ-65

+ Create issue

### TESTING REQUIRED 2

#### Add security section of report

75%

☒ NRVZ-61

#### Add conclusion section of report

50%

☒ NRVZ-62

### DONE



# Requirements

## Functional Requirements

- As a user, I can see the full graph of a valid uploaded model once it finishes processing.
- As a user, I can pan and zoom the model visualization.
- As a user, I can export the graph to  $\text{\LaTeX}$  TikZ syntax.
- Etc.

# Requirements

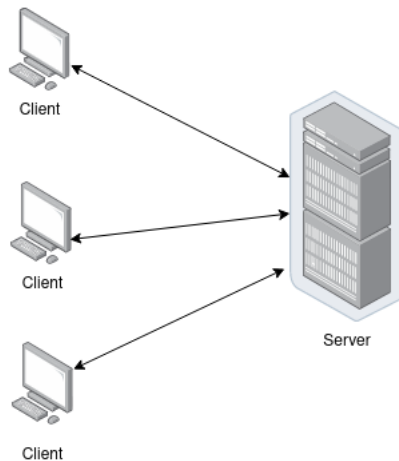
## Functional Requirements

- As a user, I can see the full graph of a valid uploaded model once it finishes processing.
- As a user, I can pan and zoom the model visualization.
- As a user, I can export the graph to  $\text{\LaTeX}$  TikZ syntax.
- Etc.

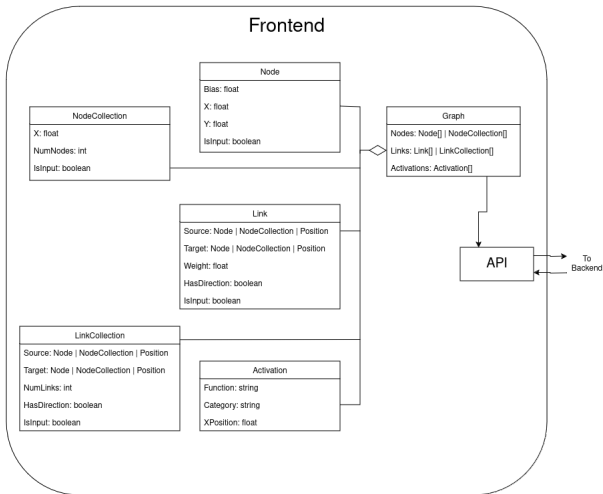
## Non-Functional Requirements

- Large network layers are collapsed if they are too big to reasonably render.
- Invalid models are rejected and not stored on the server unnecessarily.
- Etc.

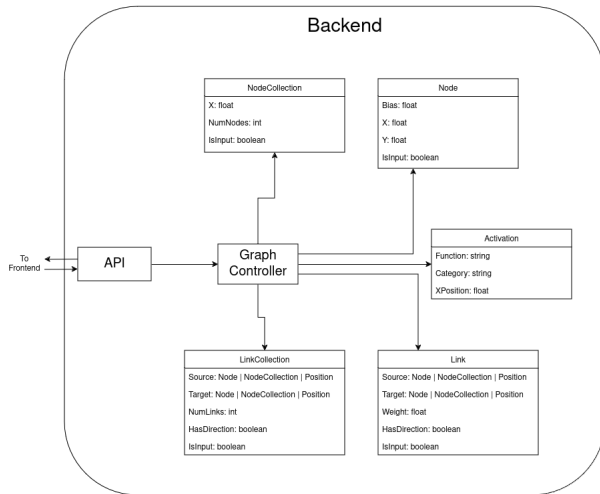
# Web Application



# Frontend Design



# Backend Design



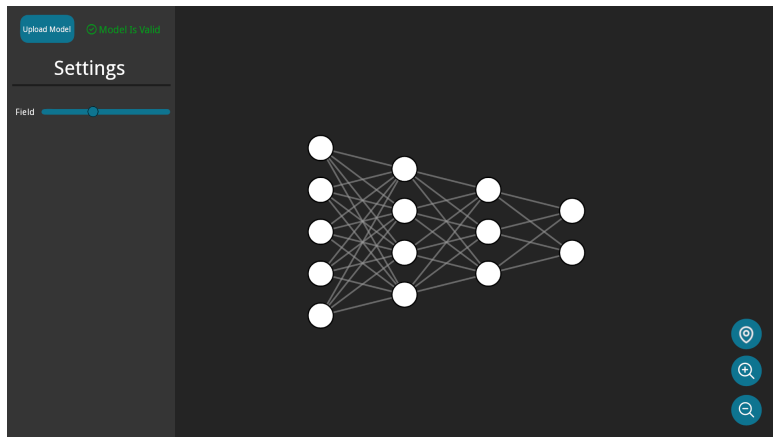
## Database & Sessions

- `_id`
- `graphs`
  - `nodes`
  - `edges`
  - `activations`
- `last_used`





# User Interface



# User Interface

Select Model:

STE\_IRts\_Large\_Even\_La... X

gpt4.keras


☒ Model is valid

**Settings**


☐ Dark Mode

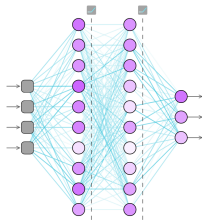
**Key**

**Weights/Links**

Lower  Higher

**Biases/Nodes**

Lower  Higher



# Frontend Technologies & Graph Generation

- Svelte
- Flowbite
- D3.js

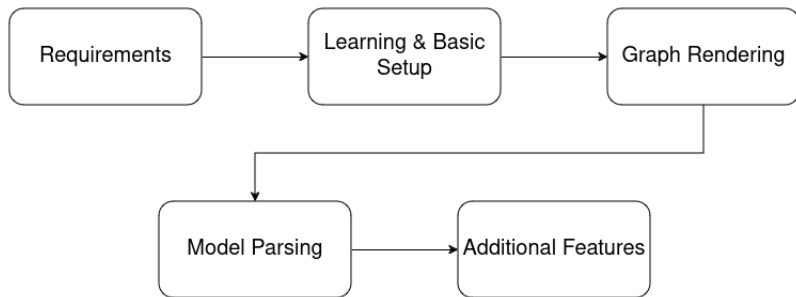


## Backend Technologies & Model Parsing

- Quart
- Keras
- PyTorch



# Development



# Deployment

- Ubuntu 22.04 LTS
- PM2
- GitHub Actions



# Testing

- Frontend Unit Testing

# Testing

- Frontend Unit Testing
- Backend Unit Testing



# Testing

- Frontend Unit Testing
- Backend Unit Testing
- Regression and Integration Testing

# Security

## Web Application Security

- HTTPS
- White-List Parsing

# Security

## Web Application Security

- HTTPS
- White-List Parsing

## Session Management

- Anonymous
- Data Pruning

# Challenges

- Lack of framework documentation

# Challenges

- Lack of framework documentation
- Information filtering

# Challenges

- Lack of framework documentation
- Information filtering
- Time management

# Future Work

- Complex network types

# Future Work

- Complex network types
- Additional frameworks



# Future Work

- Complex network types
- Additional frameworks
- Animations

# Thank you

## Questions

# Sources

- [https://www.tutorialspoint.com/sdlc/sdlc\\_agile\\_model.htm](https://www.tutorialspoint.com/sdlc/sdlc_agile_model.htm)
- <https://www.mongodb.com>
- [https://en.wikipedia.org/wiki/File:Svelte\\_Logo.svg](https://en.wikipedia.org/wiki/File:Svelte_Logo.svg)
- <https://flowbite.com/>
- <https://github.com/d3/d3-logo/blob/master/d3.png>
- [https://github.com/koddr/quart-  
logo/blob/master/src/png/quart\\_short\\_logo\\_color.png](https://github.com/koddr/quart-logo/blob/master/src/png/quart_short_logo_color.png)
- [https://en.wikipedia.org/wiki/File:Keras\\_logo.svg](https://en.wikipedia.org/wiki/File:Keras_logo.svg)
- <https://pytorch.org/>
- <https://ubuntu.com/>
- <https://pm2.io/>
- <https://github.com/>