Neural Vision: Real-Time Visuals of Neural Network Dynamics

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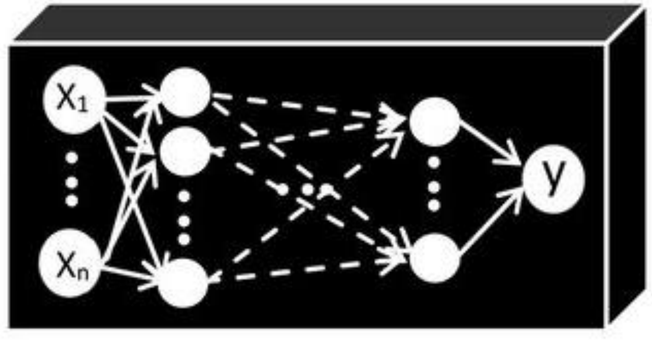
ABSTRACT

Amidst the rapid advancements in artificial intelligence, neural networks remain crucial yet enigmatic, often described as 'black boxes'. Addressing this opacity, our project introduces Neural Vision, a real-time interface that illuminates the often-invisible gradient flow throughout neural network training. This tool not only demystifies the internal workings of neural networks but also offers users the ability to tailor fully connected networks for specific visualization needs. Through the experimentation with the MNIST dataset, Neural Vision provides an insightful depiction of gradient dynamics, enhancing transparency and understanding in neural network training.

BACKGROUND & MOTIVATION

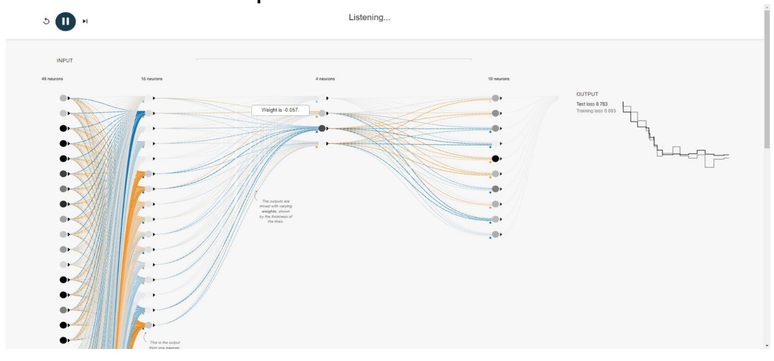
The rapid evolution of AI, primarily driven by advancements in neural networks, has been exemplified by technologies like ChatGPT. Despite these strides, neural networks remain enigmatic to many researchers. Our work addresses this by developing a real-time monitoring interface, offering a comprehensive visualization of gradient flow during neural network training.



MODEL IMPLEMENTATION

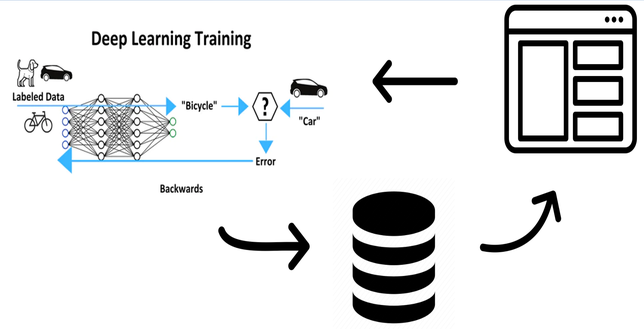
Neural Vision showcases the dynamic gradient flow during neural network training with a neuron-centric visualization. Each neuron symbolizes activations, while the connections between layers depict model parameters. Neuron luminosity and connection texture correspond to gradient magnitude. As training progresses, gradients propagate from the output back to the input neurons.

For the implementation, we leverage Django for our backend framework. Gradient data is stored in a database throughout training and dynamically retrieved by the front-end UI, ensuring a seamless and interactive user experience.



RESULTS

We have developed Neural Vision, a real-time interface for visualizing gradient flows in neural networks. Our experiments with the MNIST dataset have enabled users to observe and interact with the training process, offering customization of network architecture and hyperparameters. Future updates will introduce expanded visualization capabilities for CNNs and Transformers.



CONCLUSION

Visualization of neuron gradients flow led to more efficient network designs, aided in transfer learning, and contributed to developing robust AI systems. The project delivered significant impacts in neural network research and applications across various fields like aerospace and healthcare.

IMPACT

The "Neural Vision" project transforms AI's "black box" by making neural network training transparent through real-time visualization. This breakthrough enhances educational understanding, accelerates research innovation, and ensures reliability in critical applications like healthcare and aerospace. The interface promotes trust in AI, facilitating its adoption across diverse sectors.

ACKNOWLEDGEMENT & BIBLIOGRAPHY

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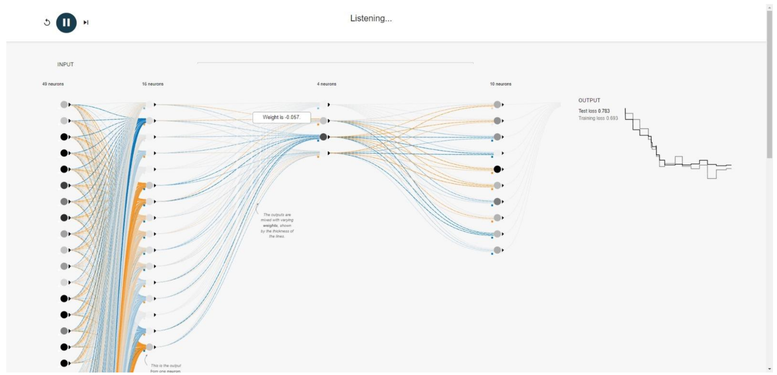
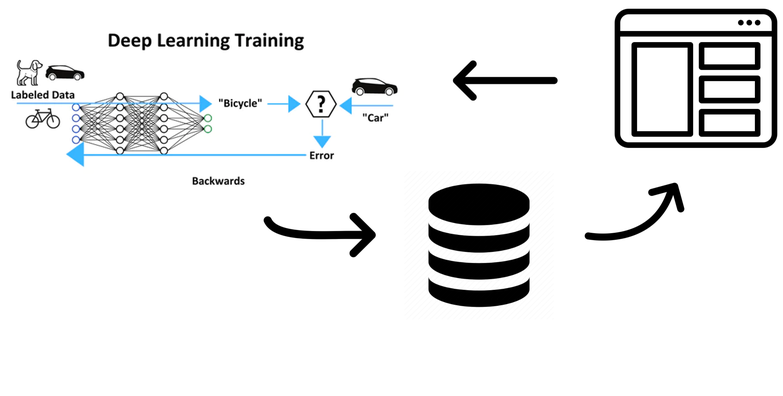
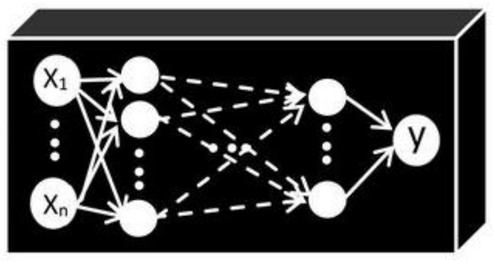
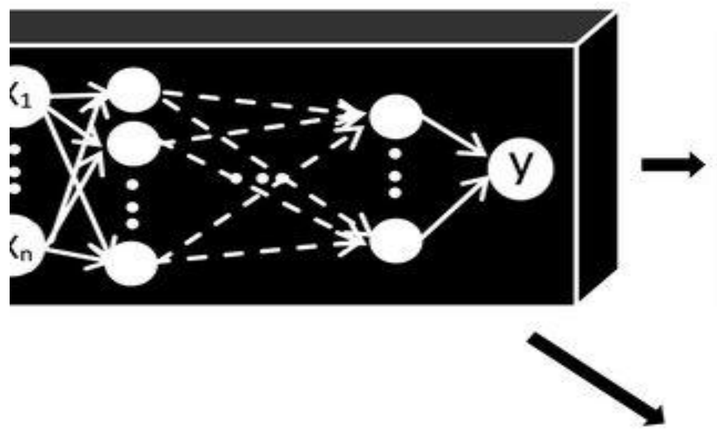

Listening...
INPUT
49 neurons
16 neurons
4 neurons
10 neurons
Weight is -0.057
OUTPUT
Test loss 0.783
Training loss 0.693


Deep Learning Training
Labeled Data
"Bicycle"
?
"Car"
Error
Backwards


X1
Xn
y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