Examining Attacks on Neural Networks

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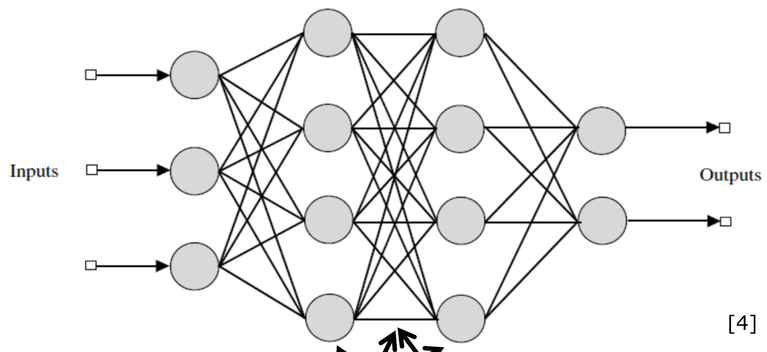
Introduction

- Neural Networks are widely applied in in systems worldwide—search algorithms, pattern detection, image recognition [1,2]
- This widespread use makes them possible targets for Cyber Attacks, which may lead to large consequences including data leakages, and further security vulnerabilities
- It is imperative that Networks have proactive measures in place that may counter act attempted attacks if detected
- Using a Classification Neural Network [1,3], we explore how attacks change the performance of models of varying layer depth and neuron density.

Network Model



[4]

Standard Feed Forward Model

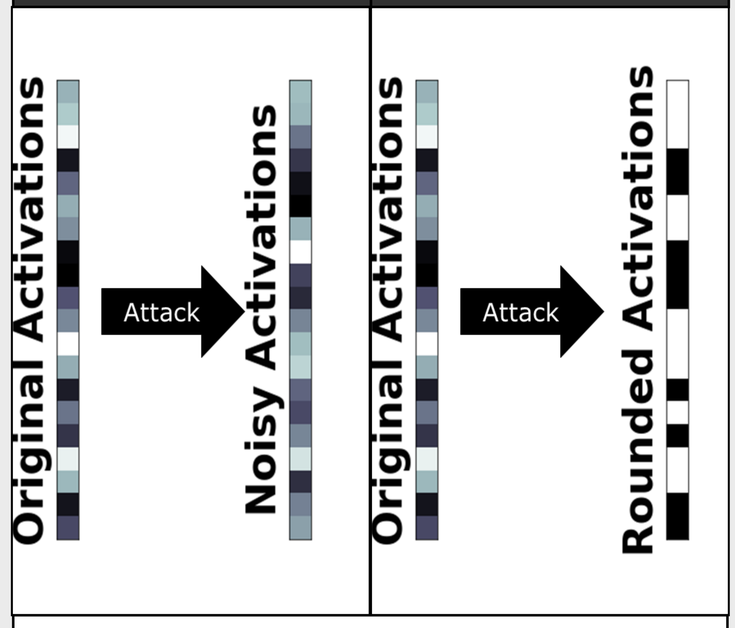
$$\vec{x}^{(l+1)} = f\left[\hat{W}^{(l)}\vec{x}^{(l)} + \vec{b}^{(l)}\right] \quad (1)$$

Attacked Feed Forward Model

$$\vec{x}^{(l+1)} = f\left[A\left(\hat{W}^{(l)}\vec{x}^{(l)}\right) + \vec{b}^{(l)}\right] \quad (2)$$

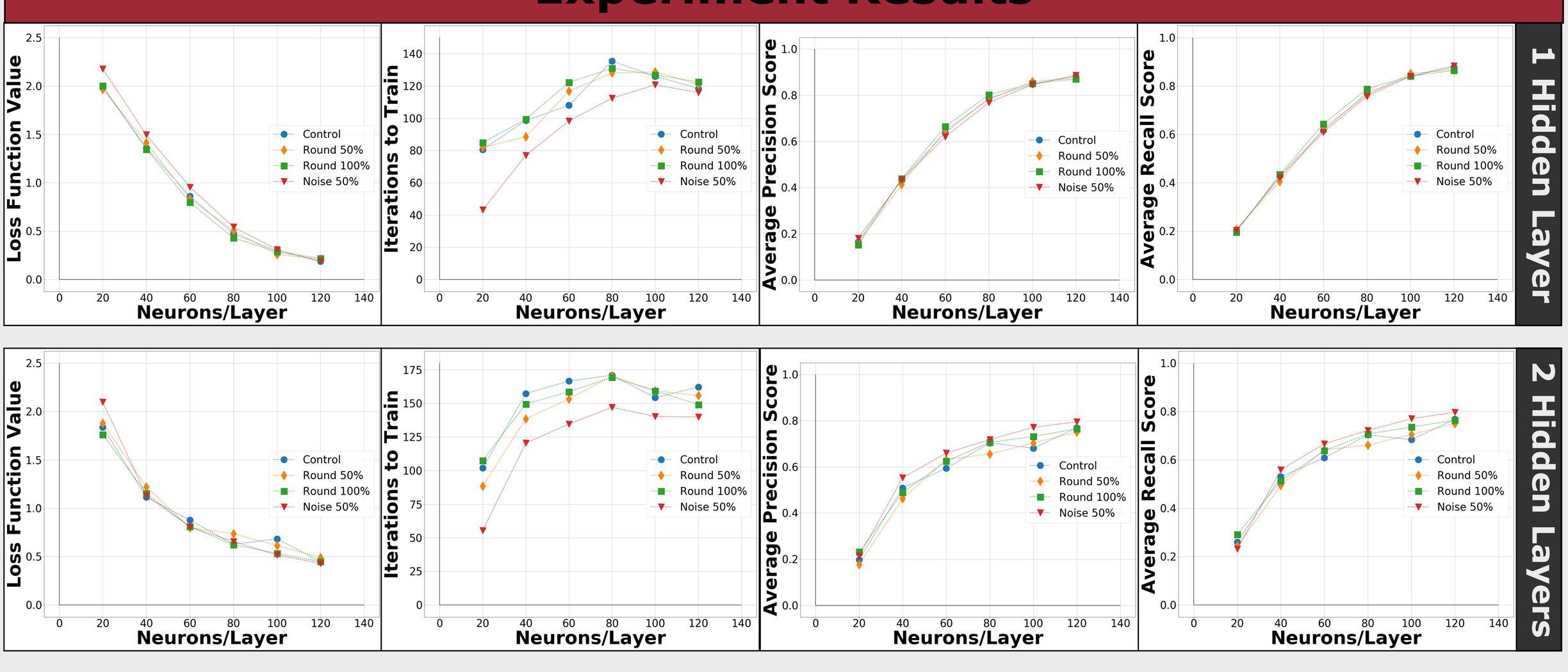
Attack Functions

Introduce Pseudo-Random Noise	Reduce Numerical Accuracy



Two different *"A"* functions are modeled using a color map to indicated how activations are changed by an attack

Experiment Results



Conclusions

- For the studies layer depths and neuron densities, attacks that target numerical accuracy show minor deviations from baseline models. These attacks would be consider *stealthy* as they are hard to detect with the given metrics.
- Both attacks that introduce noise and reduce numerical precision use fewer iterations before either converging or arriving at a *stopping criteria* [2].
- The two network depths shown indicates that for both attacks types, precision and recall scores are greater affected by networks with more layers and higher neuron densities.
- We can expand future explorations into studying attack functions changes precision and recall score given network depth and neuron densities .

Acknowledgements

This work was partially supported by the Nation Science Foundation, award number CNS-1652474.

I would like to thank Dr. Kevin Short in the UNH mathematics department for recommending me to this research position and providing additional consultation on this topic

References

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