Physics Informed Domain Adaptation

FAU I-SENSE Summer REU 2021

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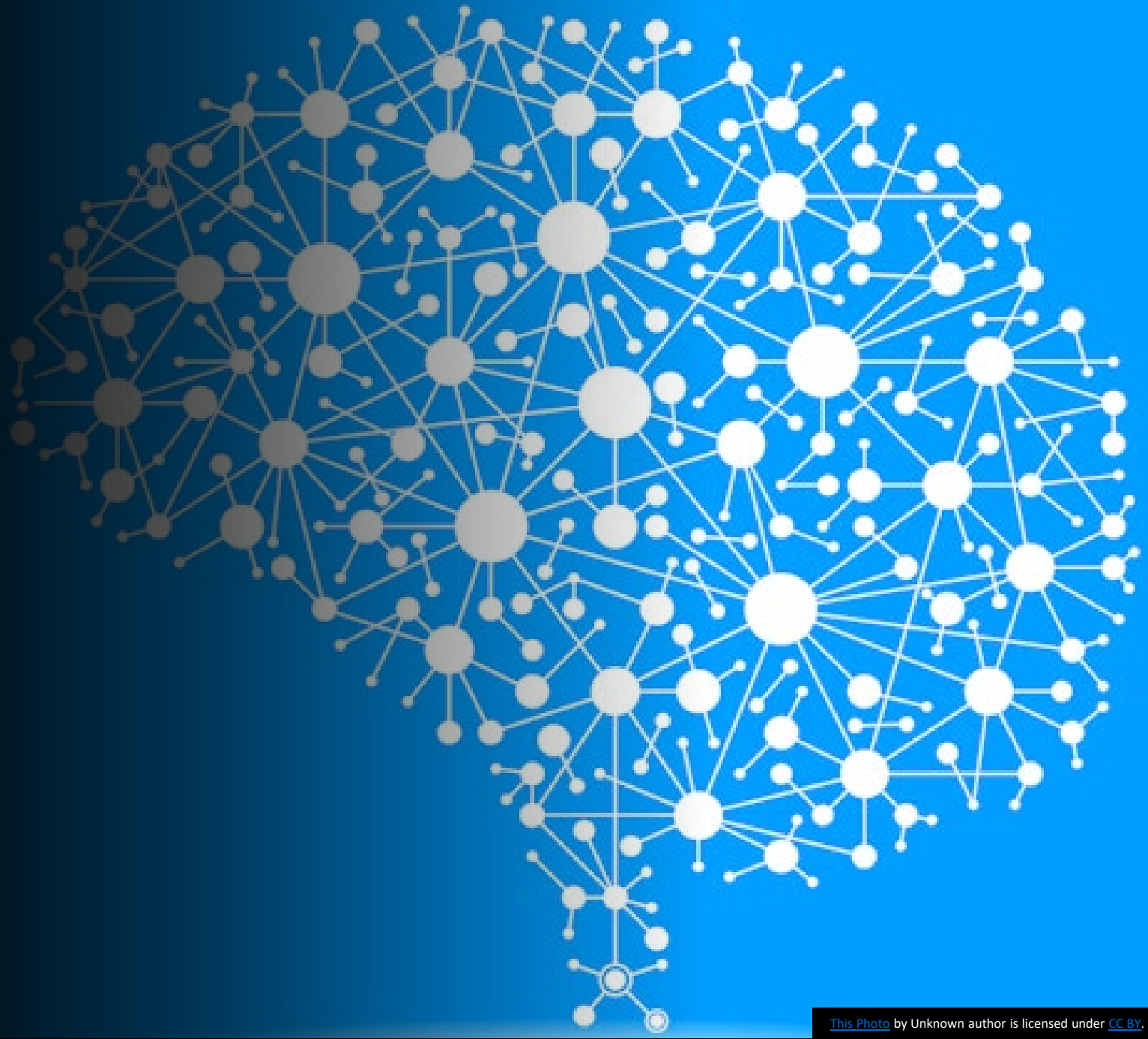


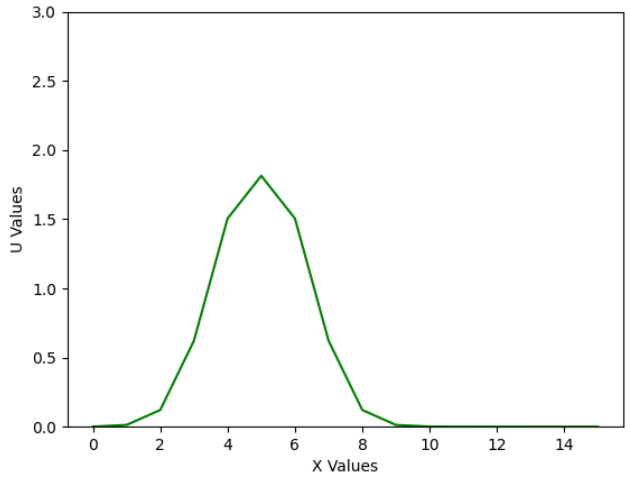
Background

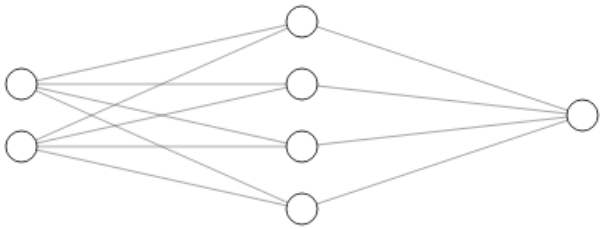
WHAT ARE PDES?

WHERE CAN THEY BE USED?

HOW CAN WE CALCULATE THEM FASTER?

$$C_1 * U_{tt} = C_2 * U_{xx} + C_3 * U_{yy}$$



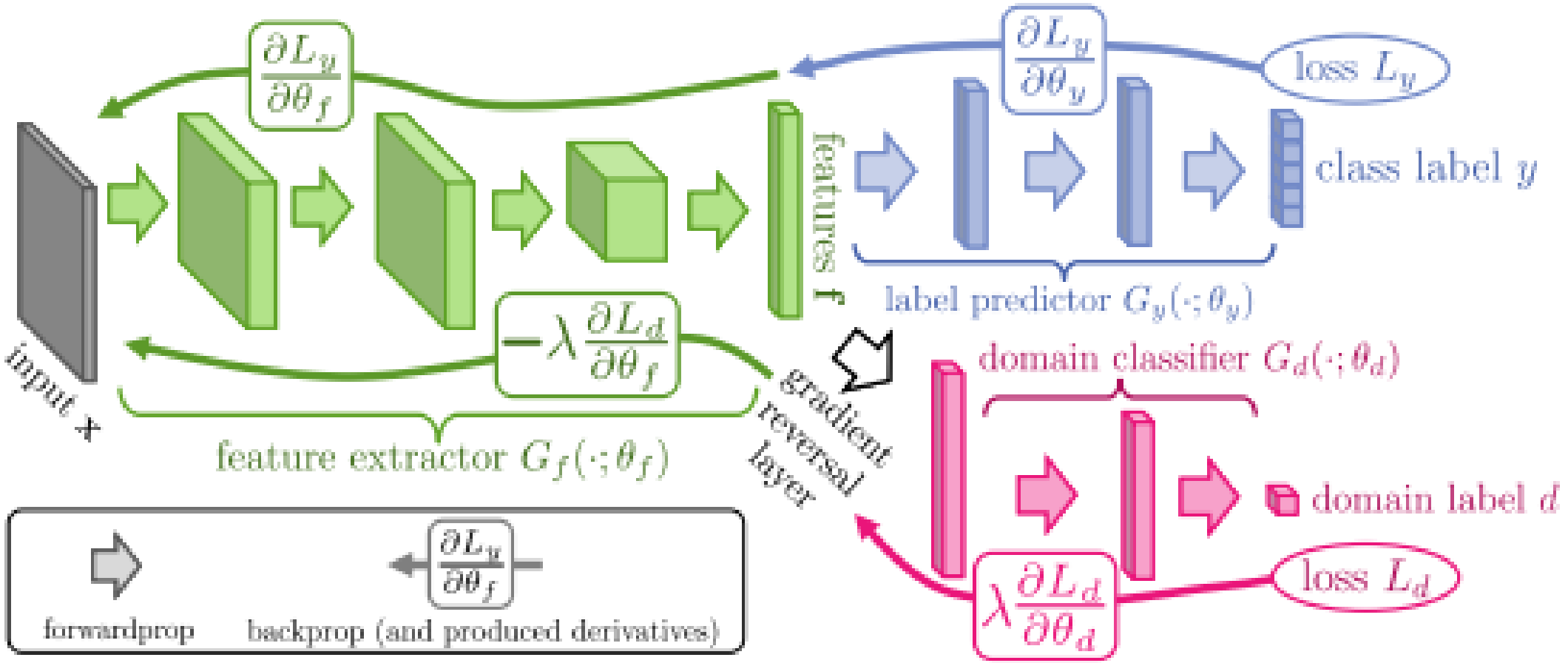


Purpose

Pinns require data to be trained

What if we can train them with different domain data?

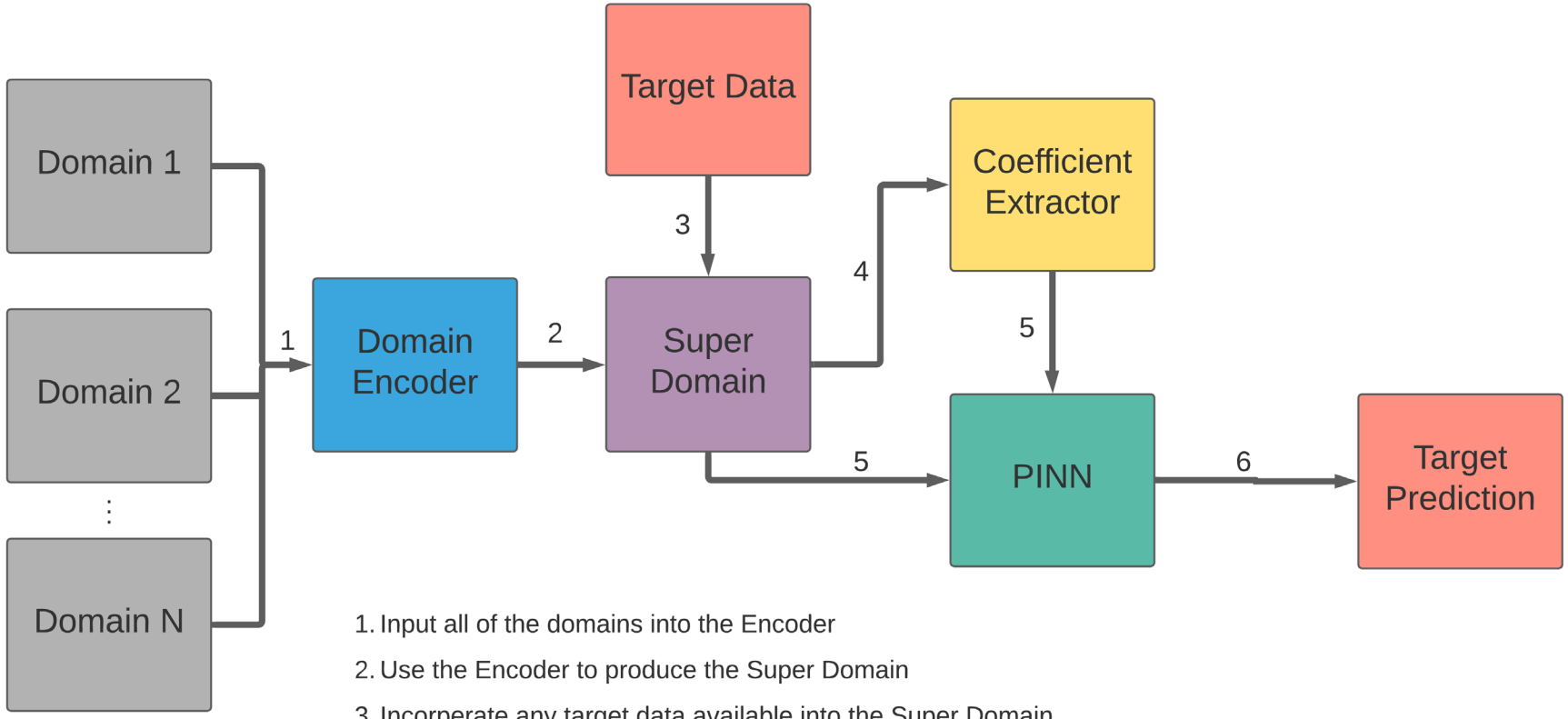
Literature Method



Ganin, Y., Ustinova, E., Ajakan, H., Germain, P., Larochelle, H., Laviolette, F., Marchand, M., & Lempitsky, V. (2016). Domain-Adversarial Training of Neural Networks. *Journal of Machine Learning Research*, *17*, 1–35., https://arxiv.org/abs/1505.07818

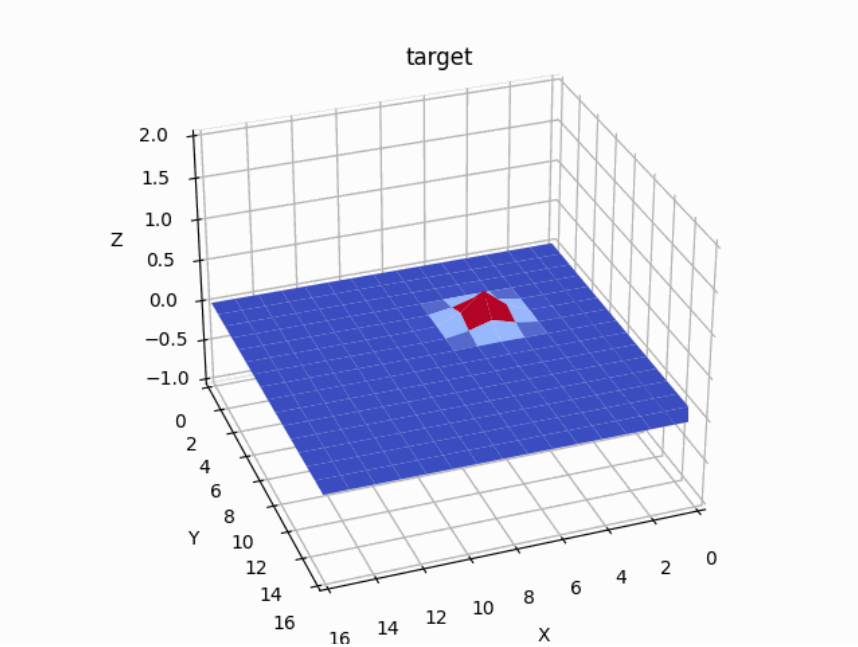
Proposed Method

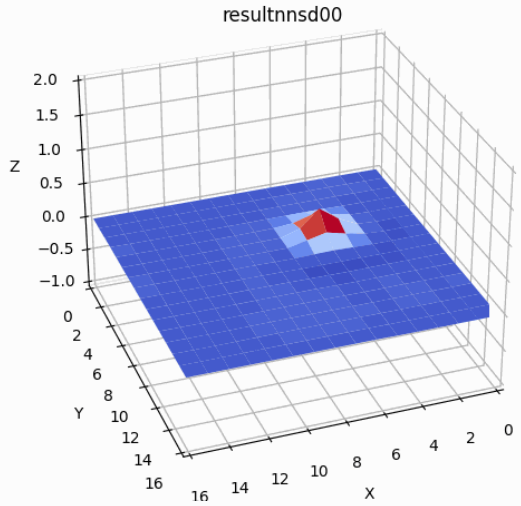
PIDA Model

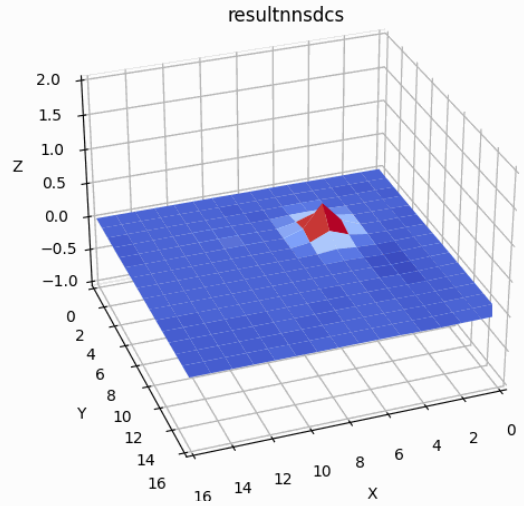


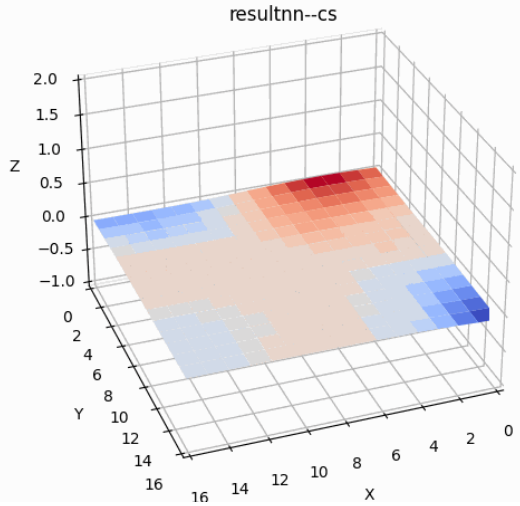
1. Input all of the domains into the Encoder
2. Use the Encoder to produce the Super Domain
3. Incorperate any target data available into the Super Domain
4. Extract the coefficients of the function produced by the Super Domain
5. Train the PINN using the Super Domain and extracted coefficients
6. Predict the target output

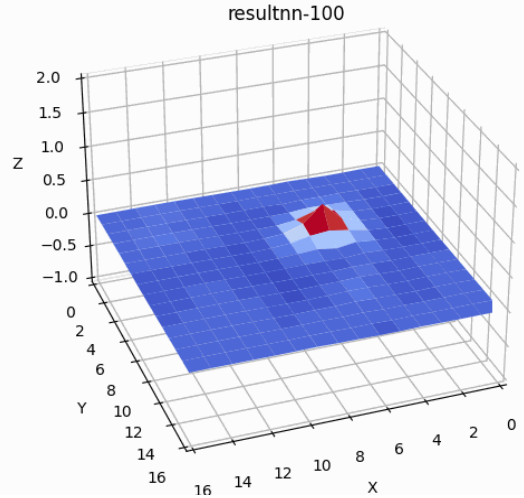
Initial Results









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Loss on target (NNSD00): 0.022129558026790 62
Loss on target (NNSD25): 0.018598152324557304
Loss on target (NN--25): 0.0473637580871582
Loss on target (NN-100): 0.0011065106373280287
```

Where to go next

1

Improve the way the target data is incorperated into the super domain

2

Do more tests on differing amounts of target data available

3

Choose domains that have coefficients similar to the target domain