Machine Learning Qualifying Exam Report Georgia Institute of Technology

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- 2 Prior Work
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[Shwartz-Ziv and Tishby, 2017] [Chaudhari et al., 2018] [E et al., 2018]

- 4 Deep Relaxation: PDEs for Optimizing Deep Neural Networks
- 5 Characterization of Neural Networks as a Encoder-Decoder with Mutual Information
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- 7 Casting Residual Networks as a Mean-Field Optimal Control Problem

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References

[Chaudhari et al., 2018] Chaudhari, P., Oberman, A., Osher, S., Soatto, S., and Carlier, G. (2018). Deep relaxation: Partial differential equations for optimizing deep neural networks. *Research in the Mathematical Sciences*, 5(30).

[E et al., 2018] E, W., Han, J., and Li, Q. (2018). A mean-field optimal control formulation of deep learning.

[Shwartz-Ziv and Tishby, 2017] Shwartz-Ziv, R. and Tishby, N. (2017). Opening the black box of deep neural networks via information.

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