Homework 5: Read and critique a biomedical paper using a deep learning-based algorithm

Find a paper that uses deep learning to analyze biomedical data using deep learning (DL). After reading the paper, write a critique of the paper. Your writeup should include:

- A brief summary of the paper, including the motivation, methodology, and major findings (3-4 paragraphs)
- A discussion of the strengths and weakness of the deep learning approach and the paper more generally (3-4 paragraphs). Things to consider:
  - What data was used to train and validate the model? How relevant is this data to the goal of the paper?
  - How much data was the model trained on?
  - What are important confounders to consider in this problem setting? How was confounding handled? How can confounders bias the results?
  - How was missing data handled?
  - How does the DL model perform relative to other simpler models (e.g. logistic/linear regression)? How significant is the performance difference?
  - What is the neural network architecture? How was it constructed and/or chosen?
  - Is the model interpretable?
  - What was the training time for the model? What computational resources are needed to run the model?

Example papers that you can use:

- Nagpal, Kunal, Davis Foote, Yun Liu, Po-Hsuan Cameron Chen, Ellery Wulczyn, Fraser Tan, Niels Olson, et al. 2019. “Development and Validation of a Deep Learning Algorithm for Improving Gleason Scoring of Prostate Cancer.” *Npj Digital Medicine* 2 (1): 48.
- Komorowski, Matthieu, Leo A. Celi, Omar Badawi, Anthony C. Gordon, and A. Aldo Faisal. 2018. “The Artificial Intelligence Clinician Learns Optimal Treatment Strategies for Sepsis in Intensive Care.” Nature Medicine 24 (11): 1716–20.
- Yuan, Ye, and Ziv Bar-Joseph. 2019. “Deep Learning for Inferring Gene Relationships from Single-Cell Expression Data.” *Proceedings of the National Academy of Sciences of the United States of America*, December.
- Ma, Jianzhu, Michael Ku Yu, Samson Fong, Keiichiro Ono, Eric Sage, Barry Demchak, Roded Sharan, and Trey Ideker. 2018. “Using Deep Learning to Model the Hierarchical Structure and Function of a Cell.” *Nature Methods* 15 (4): 290–98.

Submit your critique as a PDF, along with the paper.