

# Mount Sinai Health Hackathon

*Creating Novel Technology Solutions For Healthcare*

## Artificial Intelligence

*Expanding the Limits of Human Performance*

### Problem Statement – Professional Performance in Medicine

#### Summary

Decades ago, the promise of emerging computer-aided diagnostic (CAD) platforms cemented a laudable goal in the minds of clinicians everywhere: to reduce the number of ordinary diagnostic tasks and therefore release physicians to pursue more complex cases, improving overall patient outcomes. As it turned out, we were technologically underpowered at the time; we are not anymore! Well beyond diagnostic tasks, AI for the first time may close the loop on the story of CAD and impact virtually every element of physician performance, from diagnostics to reporting to treatment. The next ten years will witness transformative changes in the way medicine is practiced, but important technical and translational challenges remain to ensure deployment of AI in medicine effective for providers and, ultimately, patients.

#### Background

Medical professionals increasingly rely on technology in support of diagnostics and the delivery of care. Supported by the expansion of available computing resources and the scalability of AI techniques to many economically important sectors of the economy, spectacular leaps forward in AI applied to medical data sets have demonstrated impressive abilities to classify and segment medical imaging datasets, augment clinical reporting and reduce provider errors, and monitor critically ill patients, and predict clinical outcomes. AI tools have been successfully developed to interpret virtually all areas of medical imaging, as well as pressing predictive tasks such as understanding the likelihood of readmission or sepsis, which directly impacts physician decision making. All of these capabilities may serve to augment physician capability and capacity.

Deployment of these technically impressive feats into the clinical workflow has been less successful to date, owing at least partially to practical, generalization, and regulatory burdens. Perhaps most importantly, deployment of AI in support of physicians is tempting to misuse: augmented physician performance appropriately frees the provider to focus on the most complex and pressing tasks, yielding an overall improvement in outcomes for patients. Providing the appropriate environment in which to deploy tools which serve not to simply increase the number of tasks a provider can address in a given day must be a fundamental goal of any AI tool deployment. Fundamental questions remain on the appropriate level of augmentation that maximally benefits patient outcomes for providers while addressing burnout and building trust in next-generation AI systems. As a community, our technical sophistication

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makes it easy to claim that “my algorithm performs best”, but the largest obstacles come from asking the right questions to begin with in support of human performance.

### Key Examples

Several prominent fields have benefited significantly from AI platforms aimed specifically at augmenting the performance of clinicians, including in radiology, neurosurgery, neurology, pathology, dermatology, ophthalmology, gastroenterology, oncology, and cardiology. Some key examples of existing commercial technologies include:

- Viz.ai, Aidoc, MaxQ-AI; Diagnosis of stroke from computed tomography (CT) images
- Arterys – MRI and CT-based cancer diagnosis, heart interpretation

Other areas where strong academic work is likely to yield commercially-available platforms in support of clinician decision making and prediction:

- Sepsis prediction
  - Horng, S. et al. PLoS ONE 12, e0174708 (2017).
  - Henry, K. E. et al. Sci. Transl. Med. 7, 299ra122 (2015).
  - Culliton, P. et al. Preprint at <https://arxiv.org/abs/1711.11536> (2017).
- Readmission
  - Shameer, K. et al. Pac. Symp. Biocomput. 22, 276–287 (2017)
- Mortality
  - Avati, A. et al. Preprint at <https://arxiv.org/abs/1711.06402> (2017)
  - Rajkomar, A. et al. NPJ Digit. Med. 1, 18 (2018).