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Machine-learning Tools in Human-Subject Research with Limited Data

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Machine-learning and artificial intelligence are everywhere. Most of these models rely on the availability of large datasets to train complex models that are, at times, remarkably effective. In human-subject research, however, often the questions are so specific and the data so limited that it is challenging to leverage a large, high-quality dataset. This is especially true in many forms of imaging-based research, which is quite expensive, and data collection from clinical systems that may not be consistent in protocol or quality. Machine-learning models have a place in these smaller-data research projects as tools for efficiency, insight, and new forms of analysis. We discuss several examples of modest machine-learning models, derived from limited human-subjects datasets, from our work and that of colleagues in neuroimaging, orthopedic imaging, and cardiology. These models are not the endpoint of the research, but rather analytic helpers that give important new insights and suggest directions for further study.