

Machine Learning for Human Space Exploration

NASA's space exploration and other missions generate large, heterogeneous datasets that represent mission operations and science. NASA invests significant resources in collecting and storing these data. NASA's substantial mission operations and science data are only valuable because they can be transformed into useful knowledge that can guide operations of current and future missions. Manual analyses of these data are becoming increasingly impractical because of the volume, variety, and velocity of these data, as well as problems with the veracity of these data.

These problems are not unique to NASA. Other organizations, including other government agencies and companies, also have datasets for which manual methods are impractical. These organizations use commercial as well as free and open-source computer software that implement machine learning and data mining algorithms to aid in analyzing these data. Some companies are extending these existing tools for their business needs. Universities perform research and development to create new algorithms and methods in machine learning and data mining. However, these developments are not necessarily aimed at the issues unique to NASA data. In particular, as mentioned earlier, NASA mission data are of two main types. One type of data can be referred to as *science data*---these are data that relate to the science problem that represents the mission goal. The second type of data can be referred to as *operations data*---these are data representing the operations and health of the astronauts and the engineered systems that they use during the missions. Both of these types of data require:

1. Machine Learning and Data Mining algorithms that can identify useful insights in datasets within and across science and operations data with the goal of jointly optimizing science return and operational efficiency, reliability, and safety.
2. Machine Learning and Data Mining algorithms that reveal how they arrive at their decisions/insights in a human-interpretable form.

This session will explore work that has been done and is to be done along these lines and others to apply machine learning to human space exploration.