# MPI-Parallel Machine Learning Algorithms for the Analysis of High-Speed Video Data

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Parallelized machine learning algorithms for clustering and anomaly detection were used to analyze image data of hybrid rocket combustion experiments to better understand the complex flow phenomena. Recently, combustion tests with different paraffin-based fuels have been performed at the German Aerospace Center (DLR) and the whole process has been recorded with a high-speed video camera. This has led to a larger number of images that needs to be automatically analyzed [1]. Since data analysis of thousands of images is very demanding with respect to computing time and memory requirement, HeAT [2], the Helmholtz Analytics Toolkit, is used on a parallel cluster at DLR to reduce the computing time. HeAT is an open source software (`https://github.com/helmholtz-analytics/heat`) that is developed by DLR and further German Helmholtz research centers.

In this talk, machine learning algorithms are used to catch specific flow phenomena that appear during the combustion. As a result, valuable insights into the main phenomena during the combustion of liquefying hybrid rocket fuels are obtained [3]. In particular, fuel droplets entrained into the oxidizer flow and burning over the flame are clearly identified as outliers with respect to the main combustion process. In the future, the algorithms shall be used to analyze other high-speed video datasets from DLR in the area of aeronautics.

## REFERENCES

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