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Machine Learning in Heliophysical Applications: the Example of Unsupervised Solar Wind Classification

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A constant stream of plasma is continuously flowing from the Sun. This solar wind reaches the Earth and can have serious effects on our technological infrastructure and health. Multiple spacecraft to measure this plasma and its properties. Understanding where in the Sun such plasma originates help us to understand the connection between our planet and our star. We use modern machine learning techniques that extract automatically data from millions of hours of spacecraft measurements. These techniques do not require the intervention of human experts. Our goal is to allow the computer to discover the properties of the solar plasma without the bias of the scientist. We show in our work how this can be achieved and how it helps the scientists to make new discoveries.

We will present one example of such techniques: unsupervised clustering can be used to segregate different types of solar wind. We propose the use of advanced data reduction methods to process the data, and we introduce the use of multiple classification methods to visualize and interpret 14 years of spacecraft data. Finally, we show how these techniques can potentially be used to uncover hidden information, and how they compare with previous empirical methods.