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Machine learning methods to identify ICMEs automatically

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Magnetic instabilities in the solar corona lead to the expulsion of large quantities of plasma and magnetic field in the interplanetary medium known as Interplanetary Coronal Mass Ejections (ICMEs). Among them, magnetic clouds (MCs) are characterized by a low proton temperature and plasma parameter β, an enhanced magnetic field intensity with a smooth rotation of its vector components (i.e the presence of a flux rope), and a low level of fluctuations.
As the solar wind is usually supersonic and super alfvenic, MCs can eventually follow a turbulent sheath characterized by a large magnetic field intensity, high β and temperature, an enhanced proton density, the possible presence of an upstream MHD shock and a high level of magnetic fluctuations.
As shown by Shinde and Russell (2003), manual identification of ICME is often subject to biases, which leads to disagreement between the existing ICMEs lists.To overcome it, Lepping et al. (2005) proposed an automatic identification method based on thresholds on the different MCs characteristics. The method demonstrated a good recall but a large percentage of false positives in the detected MCs.
From the in situ measurements provided by the spacecraft Wind over the period 1997-2015 along with their manual annotation, we provide an automatic identification method for any new measurements using different machine learning algorithms.,
The adaptability of these algorithms combined to the results they provide indicates a possibility to apply them to detection of other events measured in situ by spacecrafts.