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Differentiation between coronal holes and filament channels from SDO image data using machine learning algorithms

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In combination with the Sun's rotation, coronal holes and their associated high speed solar wind streams (HSSs) shape the solar wind distribution in the interplanetary space. The structuring of interplanetary space is especially important for deriving changes in the kinematics of coronal mass ejections. In order to forecast HSSs we empirically relate the fractional coronal hole area to the solar wind speed at 1AU. We apply an automated method for the identification and extraction of coronal hole regions in SDO/AIA 193Å images. Due to the almost equal low intensity of coronal holes and filament channels the intensity-based detection method cannot differentiation filament channels from coronal holes. Hence, to improve the HSS forecasting method we need to distinguish filament channels from coronal holes. Compared to coronal holes, filament channels are regions of closed magnetic field lines along a polarity inversion line and are therefore different in their magnetic field configuration. Acting on this physical background we investigate the benefits of using Haralick's textural features to analyze the intrinsic texture information contained with coronal holes and filament channels in AIA and HMI images. In combination with first order statistics and shape measures, we tested several classifiers to find the most suitable decision rule for a differentiation. In order to evaluate the performance of each classifier the Hanssen-Kuiper skill score, also called True Skill Statistic, was calculated. The results reveal that all classifiers, including Support Vector Machine (SVM), Linear SVM, Decision Tree and Random Forest classifier provide good results in general.