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FACULDADE DE CIÊNCIAS E TECNOLOGIA
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Solar Feature Tracking

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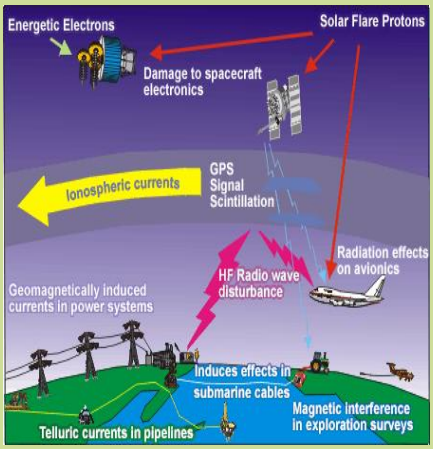
Objectives

The Sun is our main source of energy but also a dangerous one: radiation, magnetic field disruption, and solar energetic particles constantly bombard the Earth's atmosphere and magnetosphere. Thus, the Sun is the main driver of space weather. Adverse solar events can cause power grid and communication failures on Earth, wreak havoc on satellites or put astronauts at risk from radiation exposure, among other problems. One of the key approaches to study the Sun is by analyzing manifestations on the solar images.
The objective of this study is to use artificial intelligence techniques to develop a solar image processing framework, capable of automatic solar feature tracking and characterization. The resulting system would help in better understanding the solar physics and developing space weather models, as well as predictive models.

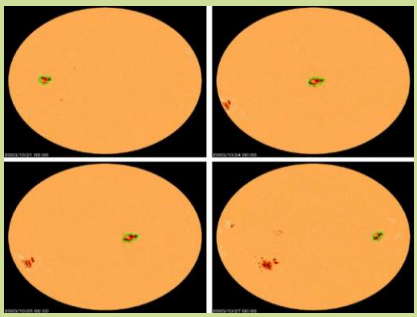
Solar Wind Image ESA)



Space Weather Effects
(Image SW Canada)

Methodology

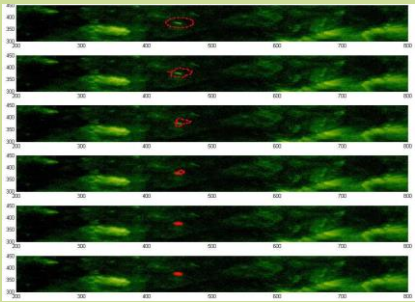
We believe that using novel artificial intelligence techniques can highly benefit the solar image processing problem. In this study we aim at developing a customized algorithm for this problem by using a novel hybrid model of Particle Swarm Optimization and Snake model (Active Contour model). Various improvements are foreseen to increase the performance and efficiency of the proposed system. Machine learning techniques will be used to keep track of detected solar feature over its life cycle and gather statistical information. For characterization of the solar features and classifying them, we will use fuzzy set theory.
The resulting system is being tested on various solar image archives from European observatories as well as NASA's.



Tracking a Sunspot

Expected Results

An automatic solar feature tracking and characterization tool;
Tracking system should be able to track a defined set of solar features, such as sunspots, coronal bright points and active regions from images obtained from ground –based or space-borne observatories. Tracking system should be robust enough for tracking large databases with irregular cadence and streaming high cadence images from SDO mission. In this system characterization is intrinsic to the tracking algorithm and a profile of each individual tracked solar feature will be created, storing details such as speed, coordinate, chirality, area and shape, at each time step. These data will be used for studying individual features and collectively will be used to extract statistical information about solar activities.



Detection and Tracking of a CBP

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FCT Fundação para a Ciência e a Tecnologia
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