

## **AUTOMATIC DETECTION OF CENTER PIVOTS USING CIRCULAR HOUGH TRANSFORM, BALANCED RANDOM FOREST AND LAND USE AND LAND COVER DATA**

**Marcos Lima Rodrigues**

Instituto Nacional de Pesquisas Espaciais – INPE

[marcos.mlr@gmail.com](mailto:marcos.mlr@gmail.com)

**Resumo.** Water management is a key field to support life and economic activity nowadays. The greatly increased mechanization of agriculture, mainly through center pivot irrigation systems, represents a big challenge to control this resource. Irrigated agriculture makes up the large majority of consumptive water use, therefore it is important to identify and quantify these systems. Currently, with  $8.2 \times 10^6$  ha, Brazil is among the 10 largest countries in irrigation areas in the world. In this study, a combined Computer Vision and Machine Learning approach is proposed for the identification of center pivots in remote sensing images. The methodology is based on Circular Hough Transform (CHT) and Balanced Random Forest (BRF) classifier using vegetation indices NDVI/SAVI generated from Landsat 8 images and Land Use and Land Cover (LULC) data provided by project MapBiomas. The candidate's circles of pivots identified on images are filtered based on vegetation behavior and shape characteristics of these areas. Our approach was able to detect 7358 pivots, reaching 83.86% of Recall for 52 tiles analyzed overall Brazil compared with mapping done by the Brazilian National Water and Sanitation Agency (ANA). In some tiles, the Recall reaches up to 100%. The BRF model trained over spectral and geometric features allowed identify pivots, where regions with great amplitude of vegetation indices highlight areas with agricultural activity to the detriment of areas of native vegetation, and also characteristics of the shapes from targets based on their delimitation through the High Pass Filter Sharr. The good accuracy achieved shows the robustness of the method to detect pivots on a large spatial and temporal scale.