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CART and IDC – based classification of irrigated agricultural fields using multi-source satellite data

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ABSTRACT
To understand water productivity of crops cultivated in the Eastern Province of Saudi Arabia, this study was conducted to generate a reliable crop type map using a multi-temporal satellite data (ASTER, Landsat-8 and MODIS) and crop phenology. Classification And Regression Tree (CART) and ISO-DATA Cluster (IDC) classification techniques were utilized for the identification of crops. The Ideal Crop Spectral Curves were generated and utilized for the formulation of CART decision rules. For IDC, the stacked images of the phenology-integrated Normalized Difference Vegetation Index were utilized for the classification. The overall accuracy of the classified maps of CART was 76, 77 and 81% for ASTER, MODIS and Landsat-8, respectively. For IDC, the accuracy was determined at 67, 63 and 60% for ASTER, MODIS and Landsat-8, respectively. The developed decision rules can be efficiently used for mapping of crop types for the same agro-climatic region of the study area.

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Crop phenology; decision tree; spectral separability; vegetation indices

1. Introduction

Crop type mapping is a key factor for the efficient management of land and water resources (Biradar et al. 2009; Heller et al. 2012). Several researchers used crop type maps in various agricultural studies, such as cropping patterns based on crop water needs (Alzahrani et al. 2012), quantification of water use efficiency (Patil et al. 2015), irrigation management (Uddin et al. 2004), decisions on crop rotation (Biradar et al. 2008), nutrient management (Patil et al. 2014), yield forecasting (Ferencz et al. 2004) and economic policies and price optimization (Thornton et al. 1997; Wang et al. 2010).

The use of satellite-based data-sets for studying agricultural fields and addressing resource management strategies started in the 1990s (de Leeuw et al. 2010; Liaghat & Balasundram 2010). The remote sensing methods used to identify crop types mainly rely on the spectral signatures of crops (Sakamoto et al. 2005; Wardlow et al. 2007; Vincikova et al. 2010) and their temporal profiles of vegetation indices (Xiao et al. 2005; Biradar & Xiao 2011). Due to the dynamic nature of the agricultural crops, the spectral reflectance of a crop may vary with respect to its phenology. On the other hand, the use of crop phenology-integrated spectral profiles improved the classification accuracy (Blaes et al.

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