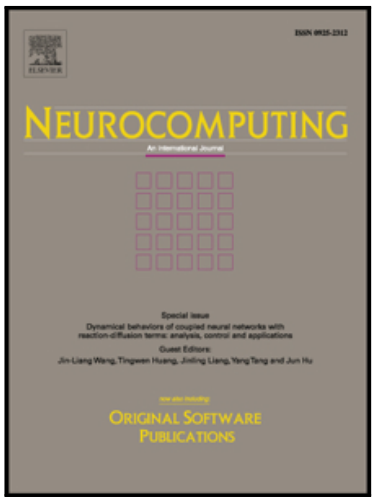

Adaptive land classification and new class generation by unsupervised double-stage learning in Poincare sphere space for polarimetric synthetic aperture radars

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Adaptive land classification and new class generation by unsupervised double-stage learning in Poincare sphere space for polarimetric synthetic aperture radars

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Abstract

Polarimetric satellite-borne synthetic aperture radar (PolSAR) is expected to provide land usage information globally and precisely. In this paper, we propose a unsupervised double-stage learning land state classification system using a self-organizing map (SOM) that utilizes ensemble variation vectors. We find that the Poincare sphere parameters representing the polarization state of scattered wave have specific features of the land state, in particular, in their ensemble variation rather than spatial variation. Experiments demonstrate that the proposed PolSAR double-stage SOM system generate new classes appropriately, resulting in successful fine land classification and/or appropriate new class generation.

Keywords:
Synthetic aperture radar, polarimetry, self-organizing map, geoscience big data

1. Introduction

Satellite-borne synthetic aperture radar (SAR) systems observe the earth continuously, globally and precisely for various purposes [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12] such as monitoring and mitigation of disaster [13, 14], forest biomass estimation for CO_2 reduction, glacier movement watching for water resource protection [15] as well as agricultural crop estimation in the near future. They are also expected to observe various natural and artificial land states. For such purposes, polarimetric SAR (PolSAR) will play an important role in newly launched and future satellite systems[16, 17, 18, 19, 20, 21, 22, 23]. In 1990s, some researchers