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## Synthetic aperture radar ship detection using capsule networks

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### Abstract

Deep Learning has become a common applied technique to improve results in a variety of detection scenarios, including Synthetic Aperture Radar ship detection. One of the most common Deep Learning techniques, Convolutional Neural Networks, have provided excellent results but have a number of limitations such as pose/position invariance. If the position of an object relative to other objects is important these details may be lost by CNN. To combat this a new Deep Learning architecture known as Capsule Networks have been introduced. Capsule networks encode various object parameters in addition to feature values to attempt to improve upon convolutions. This paper introduces new ship detection technique based on Capsule Networks and was tested against two other machine learning techniques. The new architecture shows improved ship detection accuracy of 91.03% and false alarm rates of  $9.5745 \times 10^{-9}$  and includes additional benefits such as requiring fewer samples/iterations to achieve improved performance.