Improving SAR Automatic Target Recognition Models with Transfer Learning from Simulated Data

Data-driven classification algorithms have proved to do well for automatic target recognition (ATR) in synthetic aperture radar (SAR) data. Collecting data sets suitable for these algorithms is a challenge in itself as it is difficult and expensive. Due to the lack of labeled data sets with real SAR images of sufficient size, simulated data play a big role in SAR ATR development, but the transferability of knowledge learned on simulated data to real data remains to be studied further. In this letter, we show the first study of Transfer Learning between a simulated data set and a set of real SAR images. The simulated data set is obtained by adding a simulated object radar reflectivity to a terrain model of individual point scatters, prior to focusing. Our results show that a Convolutional Neural Network (Convnet) pretrained on simulated data has a great advantage over a Convnet trained only on real data, especially when real data are sparse. The advantages of pretraining the models on simulated data show both in terms of faster convergence during the training phase and on the end accuracy when benchmarked on the Moving and Stationary Target Acquisition and Recognition data set. These results encourage SAR ATR development to continue the improvement of simulated data sets of greater size and complex scenarios in order to build robust algorithms for real life SAR ATR applications.

General information
Publication status: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing, Terma AS
Contributors: Malmgren-Hansen, D., Kusk, A., Dall, J., Nielsen, A. A., Engholm, R., Skriver, H.
Pages: 1484-8
Publication date: 2017
Peer-reviewed: Yes

Publication information
Volume: 14
Issue number: 9
ISSN (Print): 1545-598X
Ratings:
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.57 SJR 1.486 SNIP 1.7
Web of Science (2017): Impact factor 2.892
Web of Science (2017): Indexed yes
Original language: English
Keywords: SAR ATR, Convolutional Neural Networks, Transfer Learning, SAR Image Simulation
Electronic versions:
main.pdf
DOIs: 10.1109/LGRS.2017.2717486
Source: PublicationPreSubmission
Source ID: 133815040
Research output: Contribution to journal › Journal article – Annual report year: 2017 › Research › peer-review