DEEP LEARNING

Automatic Target Recognition Using Neural Networks

Deep artificial neural networks provide a powerful, data-driven, machine learning approach for addressing a wide range of problems, including image recognition and target detection. These multi-layered network solutions are especially useful in situations when the volume of information is too large for human analysis to be effective or when the problem does not easily lend itself to an algorithmic solution.

With a long track record in data processing and management solutions, the Space Dynamics Laboratory (SDL) has extensive expertise in interfacing with existing systems and tailoring software to meet customer needs.

Leveraging this expertise, SDL is implementing deep learning solutions for a range of applications, including a system to assist users in selecting and training neural networks and powerful networks for synthetic aperture radar (SAR) automatic target recognition (ATR).

ADVANCED COGNITIVE OBJECT RECOGNITION NEURAL NETWORK (ACORNN)

SDL is working with the Naval Research Laboratory (NRL) to develop an application that enables an operational user without neural network knowledge to train, evaluate, and deploy a deep neural network for image classification and ATR tasks. The neural network will use multispectral data to locate and recognize objects of relevance.

ACORNN is a prototype application being developed by the NRL and SDL. ACORNN's objective is to provide analysts with the capability to detect arbitrary objects in imagery using powerful image classification neural networks, without requiring a detailed understanding of how neural networks work or how to code. This enables rapid development of effective detectors using existing sensors, data, and personnel.
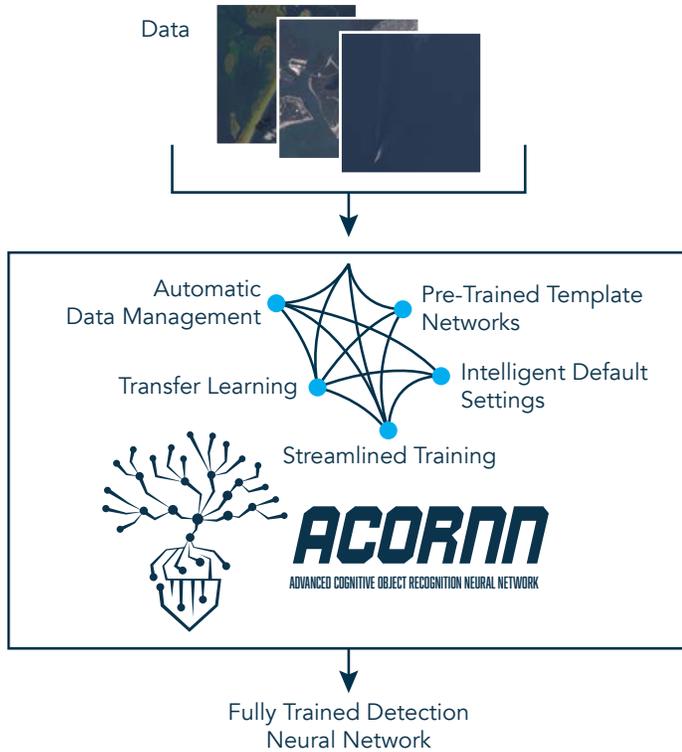
The application guides users through the process of creating a labeled dataset, building and training a network, and running new imagery through the trained network. ACORNN networks are based on well-known competition networks.

ACORNN enables users to quickly train software to detect new types of objects. This image shows land classified according to use. Image courtesy of USGS.

New network templates can be loaded into the application using the widely supported Open Neural Network Exchange (ONNX) format. This provides access to the latest technologies and methods while enabling networks to be developed and used in classified environments. ACORNN also supports iterative learning, where misclassified images can be labeled and used to further improve the classification networks.

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Data

Automatic Data Management
Pre-Trained Template Networks
Transfer Learning
Intelligent Default Settings
Streamlined Training

ACORNN
ADVANCED COGNITIVE OBJECT RECOGNITION NEURAL NETWORK

Fully Trained Detection Neural Network

FEATURES

- Imports imagery in common formats & prepares content for users to label
- Provides automatic data management
- Enables users to create new neural networks using transfer learning
- Streamlines network training
- Simplifies the process of building, training & running neural networks
- Enables users without neural network knowledge to create & train a network for a new problem in a matter of hours

SPECIFICATIONS

- Runs on Windows 10
- Requires a CUDA-compatible graphics card for optimal usage
- Imports & exports neural networks in the ONNX format
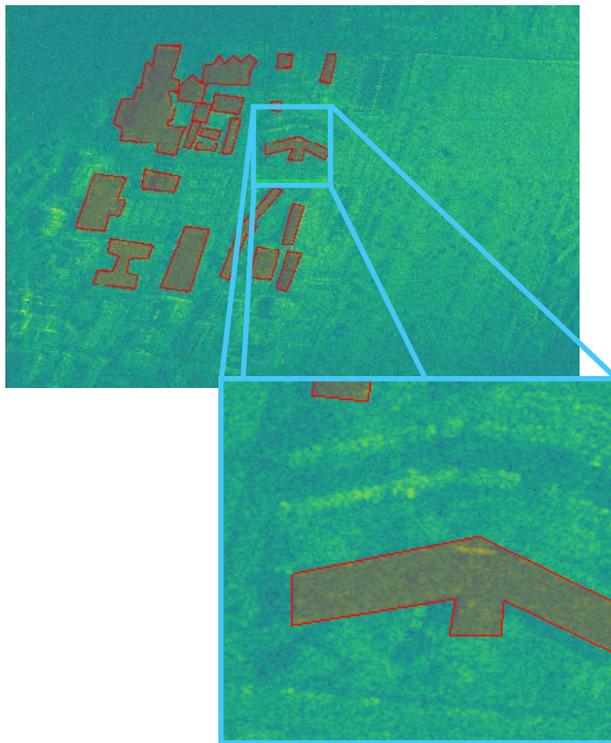
SYNTHETIC APERTURE RADAR AUTOMATIC TARGET RECOGNITION (SAR ATR)

SDL has broad experience with radar and SAR technologies, including hardware design, assembly, and testing, as well as software development for modeling, simulation, image formation, and visualization. SDL's SAR solutions acquire high-quality data for analysis.

SDL is developing deep learning capability with SAR, investigating the use of convolution neural networks (CNNs) and related techniques to perform SAR ATR on internally and externally sourced SAR data.

FEATURES

- Provides SAR handling & processing expertise
- Offers experience using deep neural networks with SAR data
- Adapts trained networks to customer-supplied datasets via transfer learning
- Reduces the quantity of data required to adapt an ATR network to a new sensor/dataset using transfer learning

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