# Clostra Capabilities Statement

Clostra researchers use state-of-the-art machine and deep learning to create innovative software for defense, medicine, business and more. We leverage our exceptional expertise in multiple Artificial Intelligence (AI) fields and combine techniques from different disciplines, letting us take advantage of a wide range of research and progress.

Our many partnerships range from applied physics labs to internet backbone organizations to startups deep in Silicon Valley, giving us access to a wide variety of otherwise unavailable data and analytical opportunities.

We employ techniques that are years away from entering the mainstream, opening up a range of powerful software solutions to solve diverse sets of problems. From deep learning to genetic algorithms, Clostra researchers are pushing the line between science and fiction.

## Artificial Intelligence Approaches

- Neural Network Classification and Anomaly Detection -
- Deep Learning with Long Short-Term memory (LSTM) for prediction -
- Reinforcement Learning (RL) and Deep Reinforcement Learning (DRL) -
- Generative Adversarial Networks (GANs) -
- Natural Language Processing (NLP) -

At Clostra, we also apply multiple AI approaches to achieve broader project goals, and to explore entirely new techniques.

## Public, Private, and Virtual Datasets

Clostra leverages a wide array of data types and existing databases for the best training possible. We routinely work with game engines, open world engines, and synthetic environments for reinforcement learning agents, data procuration, and recognition systems. We also work with Synthetic Aperture Radar data from a multitude of approaches, using both raw and processed radar signals.

Our access to unreleased datasets and state-of-the-art synthetic data generation augments our ability to train neural networks at unprecedented levels of depth.

## Our Solutions

- **Object/Signal Extraction from High Noise (low SNR) Environments:** Use of multiple neural network architectures in various projects to process signals and classify signatures. Carefully customized residual neural network and other types of architectures have proven highly effective at extracting signals from extreme levels of clutter (approaching 99% noise). Classification, object enumeration, and more subtle types of signal processing have been enabled by creative use of deep learning techniques.
- **Anomaly Detection:** Use of neural networks to construct complex baselines for anomaly detection. Arbitrary time-series data has been used to generate baselines which include many thousands of distinguishing features, including time/day sensitivity and other often ignored features. After baseline creation, Clostra can identify anomalies with extremely low false-alarm rates. For example, our anomaly detection algorithm can “understand” that the day before Christmas might see a spike in merchandise sales, but a decrease in stock trading volume. Because of this deeper understanding, true anomalies can be identified and flagged, and “expected” anomalies ignored.
- **Figure/Object Reconstruction in 3-D space from 2-D imagery:** Algorithms using image segmentation, automatic pose estimation, and ML mesh reconstruction with GAN-enhanced occlusion control allow for on-the-fly transformation of 2D images into realistic 3D spaces.
- **Systems Training using DRL:** Where data is sparse, training DRL agents in simulation environments can provide deep insight into unknown action spaces. Defining and applying state variables to system controllers as inputs into the DNN along with policy and reward based on achieving optimal performance (using real world performance metrics for validation). Once trained, such controllers can be deployed as “trained agents” to test (and train further) within the context of (a) widely varying conditions and/or scenarios, and (b) multiple form factors. Such simulations provide operators with a basis for rapidly responding to otherwise unknown situations as well as eventually being deployed in real life form factors (rigid bodies).
- **Event Prediction using Big Data, DL LSTM:** Applying multilayer neural networks (DNN) to voluminous historical data often discovers trends where mathematical modeling fails. Non-numerical, socio-political (-economic, -cultural) data, mathematical “agent” modeling often fails, where DL with “memory” (LSTM – a constrained type of RNN) can identify trends and, from them, predict outcomes, providing human researchers and responders sufficient insight to increase preparedness for rapid shifts in world events.
- **Data Curation using NLP:** Augment and refine partially-labeled training data to speed up delivery of ML/DL solutions. For example, following LSTM language modeling, vectorize the word corpi and embed words in a continuous vector space. Enhance the vector space modeling (VSM) by bypassing the Distributional Hypothesis (words occurring in the same contexts tend to have similar meanings). An LSTM approach to language modeling solves the problem of data sparseness and can capture contextual information in a range from sub-word-level to corpus-level. Sub-word modeling and large-context DL approach to language modeling (and hence to TM) might allow “blind” techniques such as Ngram methods to be abandoned.

## Public Partners

CLOSTRA
*Machine Intelligence, Applied.*

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