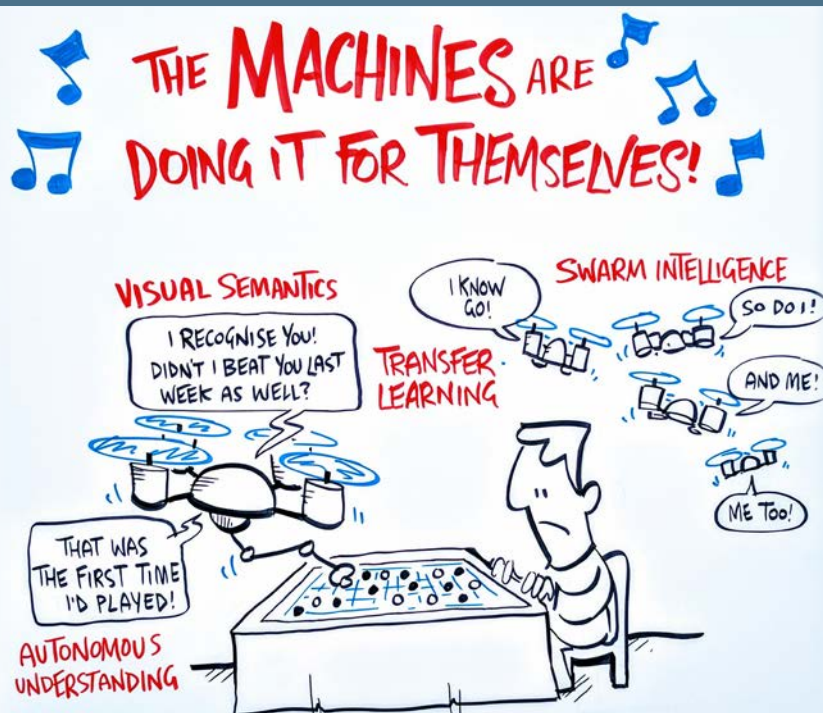# Artificial Intelligence and Machine Learning

Eagle Warrior - Ad Astra

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Roke has a strong heritage of successful projects in the defence domain. A leading provider of cutting edge research & development, we have 60 years of experience behind us and a forward-thinking team that combines the finest engineering, scientific and mathematical minds in Britain.

Holding extensive experience in communications systems, autonomy, sensors, data science and cyber, we successfully apply innovative technologies that benefit our national security, militaries and businesses.

Artificial Intelligence (AI) is a rapidly growing field of research which experts predicts will have a significant impact on our way of living – far more even than the industrial revolution.

Industries such as medicine, cyber security, autonomous systems and lifestyle products are already benefiting from this technology.

Roke has been at the forefront of this scientific endeavour by developing cutting-edge AI for commercial, national security and defence applications. Building on a strong foundation of research and academic collaborations, we have applied and adapted technology to operate across domains.

With so much existing research and expertise available, the investment from the MOD is significantly reduced to get the capability off the drawing board and into service.

PAST AI SUCCESS

Roke presented several AI technologies for the Royal Navy's 2017 Information Warrior:

STARTLE

Bio-inspired technology for rapid threat detection and analysis, which has been demonstrated in various environments including Maritime.

The technology combines an artificial neural network for rapid processing of vast quantities of data provided by the platform's sensor systems for situational awareness, including the air picture. This is complemented by a rules engine derived from domain experts' knowledge to deliver assurance and traceability.

REINFORCEMENT LEARNING

Self-learning systems are becoming critical for the development and evolution of AI.

The technology allows machines and systems to optimally learn and adapt to their environment based on their own experiences, much like humans do.

Video games have been used as laboratory environments to develop the concept. Recently Google DeepMind AlphaGo has demonstrated that such a system can defeat the world's best Go game players.

Roke uses similar technology to train autonomous systems, such as Unmanned Ariel Vehicles (UAV) that are capable of conducting complex operations by specifying simple high level learning commands. This includes operations such as navigating hostile areas without being spotted, while the system defines and learns the details to successfully complete the mission.

VISUAL SEMANTICS & TRANSFER LEARNING

Roke's transfer learning technology allows for sharing knowledge between AI systems to reduce the requirement and effort for the learning process.

Without using any training data, this capability applies existing machine learning knowledge (or models) to new real world situations.

During the Information Warrior Hackathon, Roke demonstrated a system which identifies everyday items in images and adapted it to identify similar scenes in UAV and infrared footage. The technology is based on visual semantics that is analogous to the human brain processing when evoked by different activities.

These activations of the 'artificial brain' are used to identify objects or scenes that are similar in 1000s of hours/miles of footage in the visual and infrared spectrums without the need to label them.