Australian Government
Department of Defence
Science and Technology

A Review of Intelligent Decision Support Systems for Land Tactical Planning

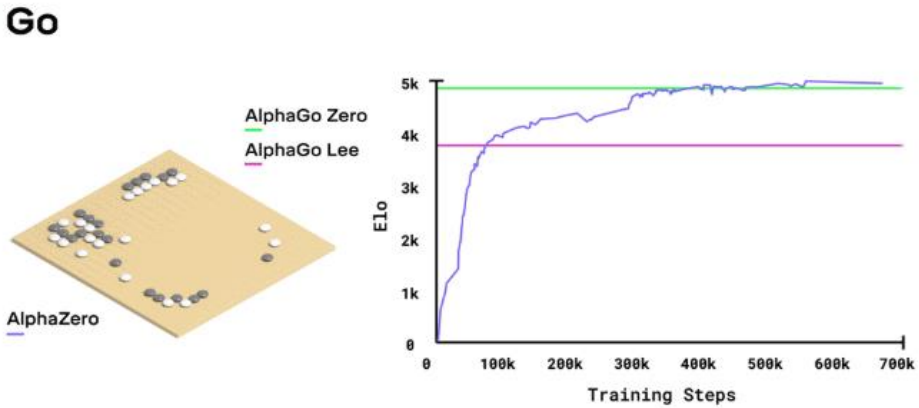
Gary Coombs

Land Division

We're witnessing an AI boom

ATLAS humanoid

AlphaZero

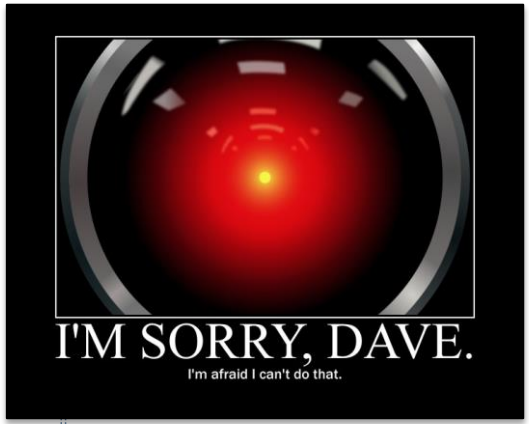


What issues might AI pose for decision makers?

"Decision cycles are likely to become faster than the capacity of human cognition to process." - MAJGEN Mick Ryan, 2018

We need machines "able to rapidly analyse huge volumes of data, see patterns and make observations and recommendations."

– Army's Robotics and Autonomous Systems Strategy, 2018



Review of the current art of intelligent decision support systems (IDSS)

- What IDSS are currently available, or in development, to support tactical command and control decisions?

- What can we conclude about the utility of current land tactical IDSS to support human decision-making?

Tactical planning at combat team level

- Structured thinking using Military Appreciation Process
- 2 - 6 hours planning horizon
- Mud models, paper maps
- Verbal wargaming, red teaming
- Moves and counter-moves
- Deception, deceit, surprise
- Rational and intuitive thinking

Search method for the review

- Evidence synthesis: Google Scholar, DTIC, NASA TRS, RAND, Proquest Military, and SearchLight
- Keyword search: land tactical decision support apps with AI or simulation engines
- 260 potentially relevant publications, 1981-2019
- Shortlisted by title and abstract scan – 110 reports discussed relevant to land tactical IDSS
- Interviewed 15 researchers across DST working in decision support and AI

Land tactical decision support systems

Task
Mission Analysis
Generation of Enemy COAs
Friendly COA Development
COA Analysis
Task scheduling, target prioritisation

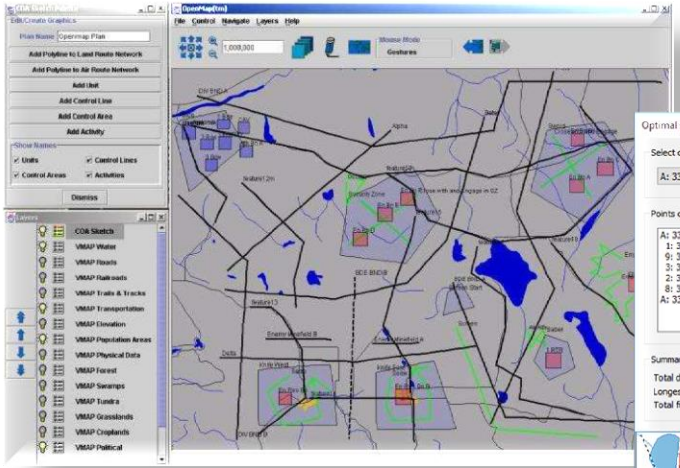
Land tactical decision support systems

Task	Research Prototypes
Mission Analysis	Deep Green (2008) TIGER (2009)
Generation of Enemy COAs	Weasel (2003), RAID (2005), Deep Green
Friendly COA Development	FOX-GA (1998), RAID, Deep Green
COA Analysis	ATACKS (2006), FOX-GA, RAID, Deep Green
Task scheduling, target prioritisation	CADET (2002), COAST (2004), Recommender (2018), TDSS (2016)

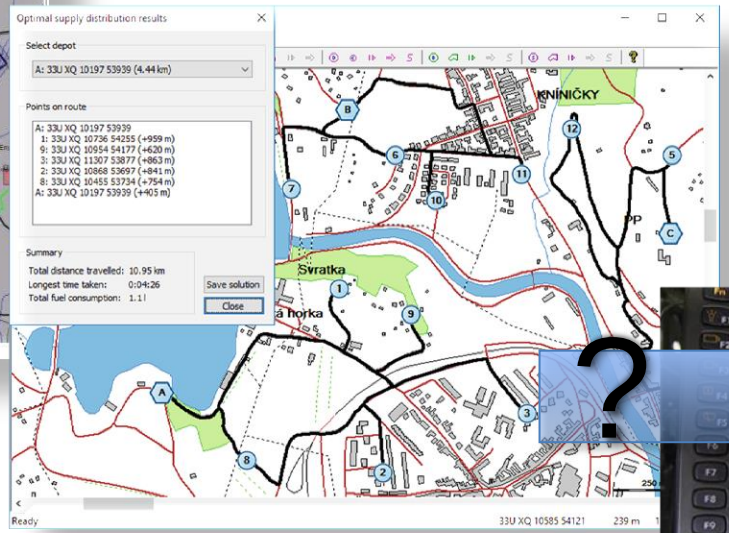
Land tactical decision support systems

Task	Research Prototypes	MOTS Systems
Mission Analysis	Deep Green (2008) TIGER (2009)	None
Generation of Enemy COAs	Weasel (2003), RAID (2005), Deep Green	None
Friendly COA Development	FOX-GA (1998), RAID, Deep Green	None
COA Analysis	ATACKS (2006), FOX-GA, RAID, Deep Green	MORPHEUS (proposed…)
Task scheduling, target prioritisation	CADET (2002), COAST (2004), Recommender (2018), TDSS (2016)	Merkava Barat MBT, ADLER, RCIDSS, Taranis Battlefield

Why haven't these systems moved out of the lab?



CADET editing tool (2008)



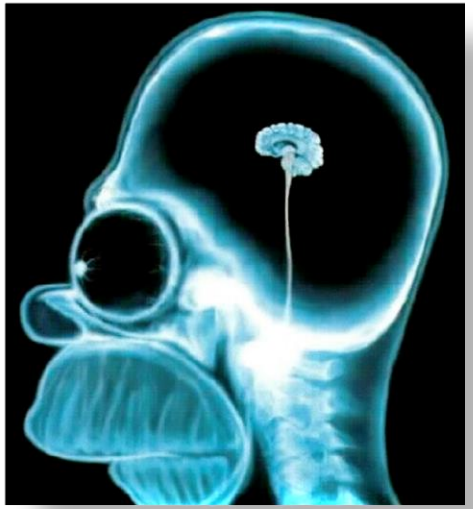
TDSS optimal logistics model (2016)

?

MOTS BMS

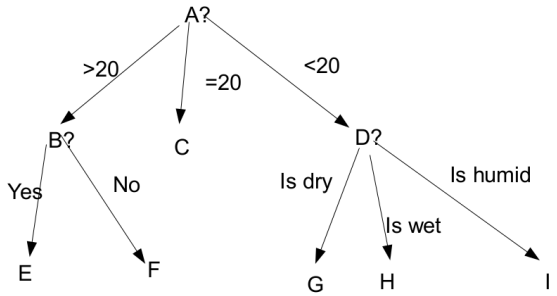
The three ‘waves’ of AI (DARPA perspective)

1. Handcrafted knowledge
2. Statistical learning
3. Contextual adaptation?



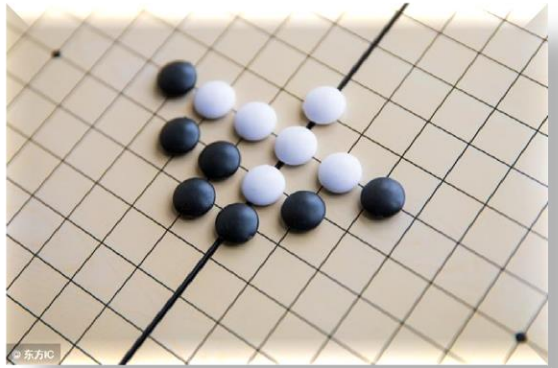
Problems with ‘handcrafted knowledge’ approaches

- Inflexible, require well-defined problem
- Difficult to capture expert knowledge
- Little or no learning capability
- Hand-coded knowledge bases costly to develop & maintain
- Computers can’t ‘see’ reality – they need digitized data
- ‘Combinatorial explosion’ problem
- Abstractions lead to unrealistic outputs

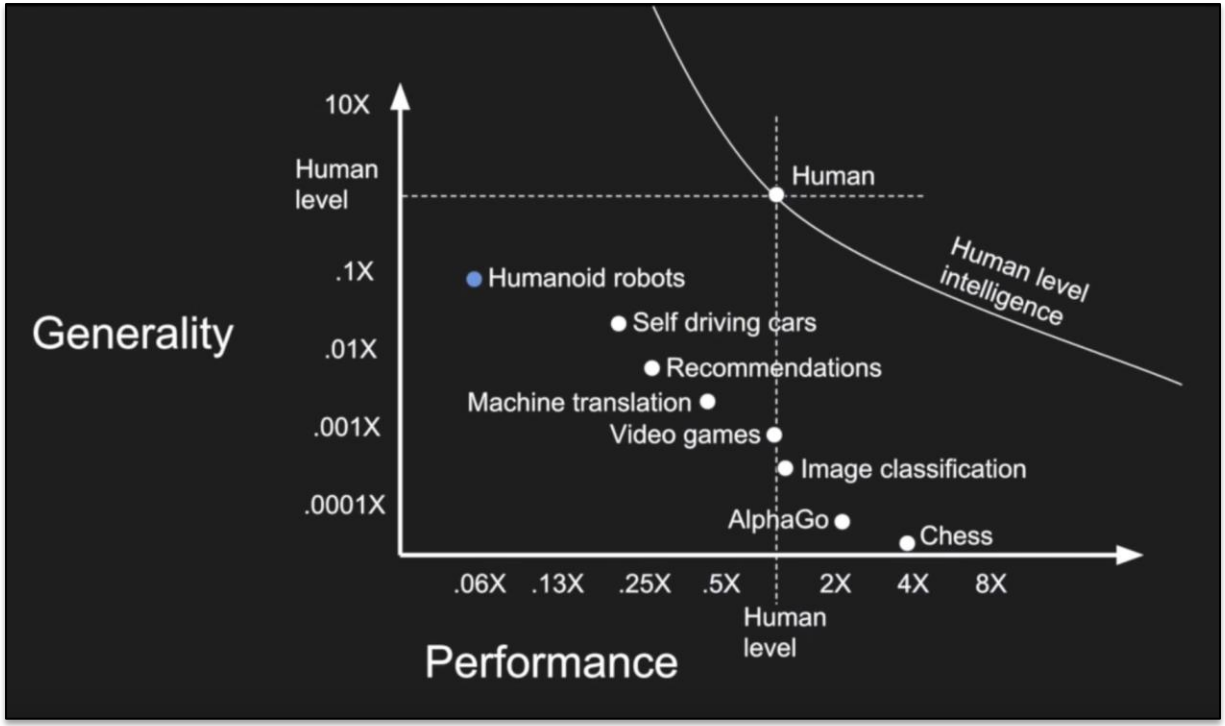


Limitations of machine learning approaches

- Need large, clean training data
- Niche applications, brittle, no context awareness
- Computationally expensive – specialized hardware/software
- Biases inherent in algorithms
- Can be gamed by adversaries
- Difficult to explain their reasoning



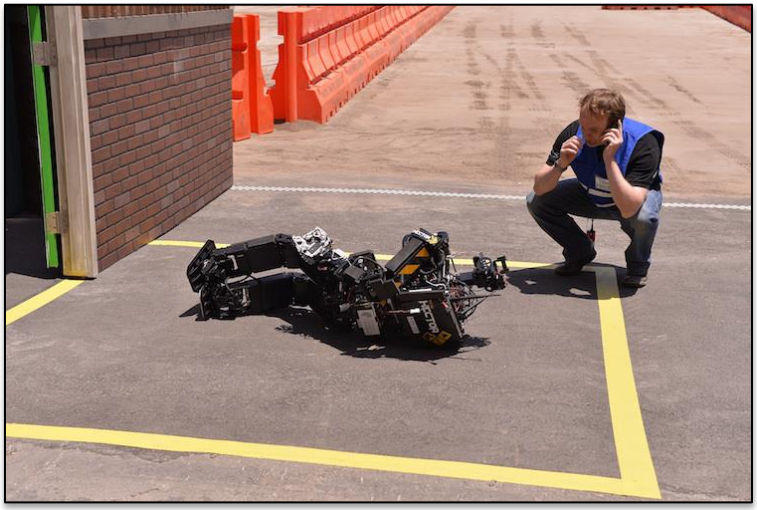
The quest for General AI



Source: Brandon Rohrer (2018)

Conclusions

- AI-enabled niche higher HQ tasks
- Support ‘front-end’ decision processes



- Enhanced training
- AI literacy

How smart does AI need to be?

The quest for General AI…