AI in the Military

Raunak Chowdhury and Jonathan Singer

Demand for Military AI Technology

The “Second Cold War” and “AI Arms Race”

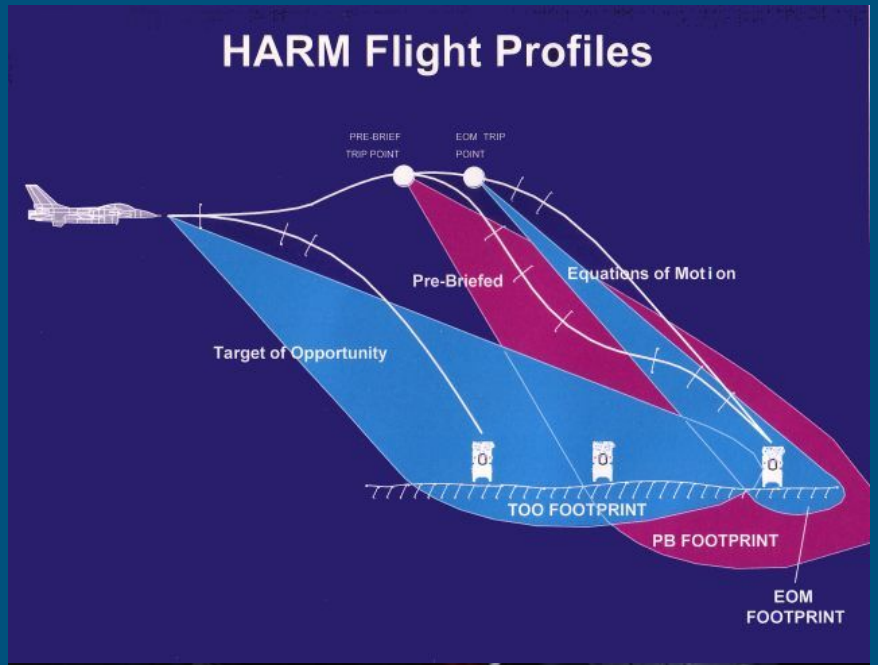
- China has announced to be a global leader in AI by 2030, shown by its AI surveillance system
- This has spurred increased development and scrutiny in the US
- Autonomize warfare and reduce costs
- Proof-of-concept: Dynamic Analysis and Replanning Tool (DART)
    - Played a pivotal role in Operation Desert Storm; saved millions of dollars

What are the implications of an “AI Arms Race?”

HTS (HARM Targeting System)

What is HTS?

- A new missile primarily for use in the F-16 aircraft
- Built to hone in on electrical transmissions and can target specific kinds of transmissions
    - This ability to specify targets makes it ideal for use in destroying ground to air weapons such as SAM batteries effectively



ATLAS (Advanced Targeting and Lethality Automated System)

What ATLAS does

- Increase the amount of response time for tank gunners in combat
- Under contention because this essentially turns tanks into killer robots
- Allows tanks and other vehicles to acquire, identify, and engage targets 3x faster than under a manual process
- Uses image processing to map terrain and ML to predict potential targets (like another system that will be covered later)

How ATLAS works

- Collects data from the environment (temp, weather, background) and uses AI for data processing
- At least three layers of ML complexity involved in this process; expected to be a massive increase in terms of armor lethality
- The call for technologies related to this happened in 02/2019, showing how recently interest in them has developed
- The issue is ethics: DoD explained that “autonomous killer tanks” would not be allowed
    - However, the R&D of such systems is still ongoing

Other Targeting Systems

Target Recognition and Adaption in Contested Environments (TRACE) program

- Rely on AI for target recognition especially in fluid and dynamic environments as enemies duck and weave behind decoys, causing pilots to fly closer to the ground to seek targets, exposing them to SAM and AA fire
- The issue with similar systems in the past: they were too computation and power intensive to be carried on aircraft
- Using a deep learning system may be able to surmount those classification challenges
- Much like ATLAS

On What Principles Do These Systems Work?

Who is doing this research?

- The US has many research programs into AI targeting systems currently active
  - Most are in public-private partnerships
  - Some are direct initiatives of the US military
- The other main investor in this research is the Chinese government

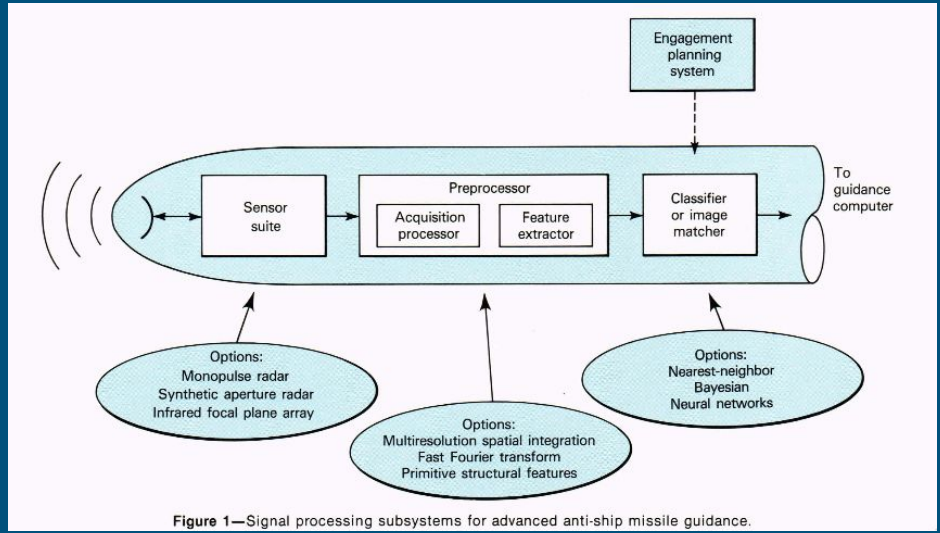


Figure 1—Signal processing subsystems for advanced anti-ship missile guidance.

One approach to missile targeting

Why are new approaches needed?

- Many neural nets used for this application already exist
- These systems rely on a certain number of constraints such as the following:
  - That the target is stationary or its motion is constant
  - That the field of view of the missile is infinite
- The training data created for these missiles can’t deal with many real world examples of applications of surface to air or air to air missiles
- More complex neural nets are more and more necessary as line of sight detection becomes very difficult the more complex the motion of the missile and the target are.

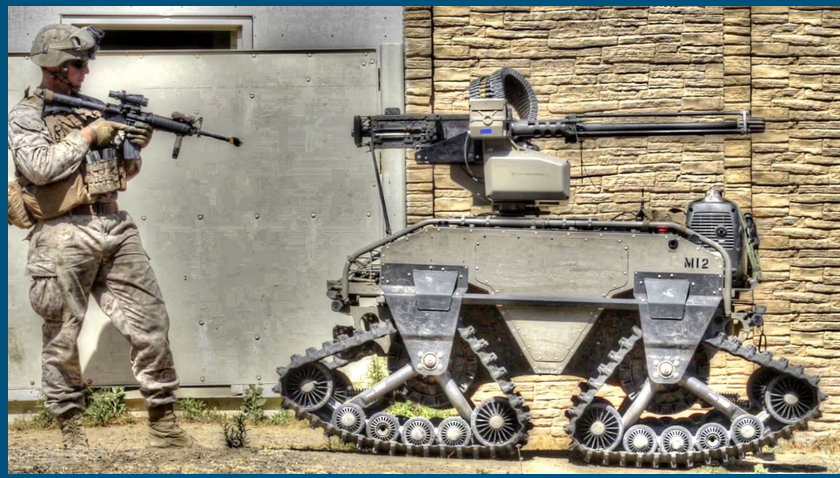
Why is this such a hard problem to tackle?

- There are many sensors that can be placed on a missile, but determining which inputs should be fed to the neural net and how is very difficult
- It is ambiguous of what should be defined as error for the neural net, as distance to the target is not always the best metric
- The need to generate training data that properly simulates real world conditions that missiles may be working under creates a challenge for researchers
- Most approaches use the changes in measurements from the gimbal located on the missile and the missile’s camera as input

Ethical Implications

What are these AIs capable of

- Speed up data interpretation and reaction speed
- Designing things to kill more efficiently raises a huge ethics issue that is recently creating a hotbed of debate
- More targeted killing can help decrease collateral damage and reduce civilian deaths
- However, the same technology may lead to more attacks, and higher fatality rates



Should/will robots respect the Geneva Conventions?

Criticisms

- Many also criticize this technology as they don’t think it is right for “machines” to make “decisions” that kill people
- Google withdrew from Project Maven, a project for studying video footage to more accurately aim drone strikes, following protests by employees


PROGRAMMED
TO KILL
TOMORROW'S
WORLD

Other Issues

- If American companies keep pushing back against military AI research, the US could fall behind in technological development; the most advanced AI tech would belong in the regimes that didn't care as much about civil liberties (RAND)
- From a pragmatic perspective, the Geneva Conventions and public outcry against AI in military use pose major roadblocks to development
- However, those moral and ethical boundaries exist and cannot be ignored

What do you think?