Artificial Intelligence in Missile Technology and Military

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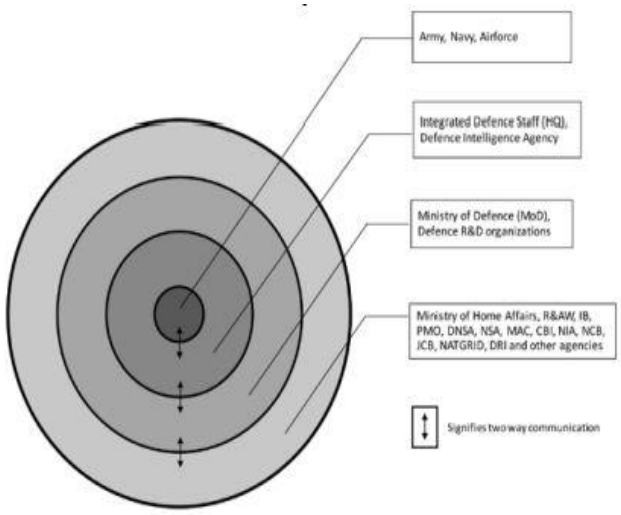
***Abstract*— This paper will be giving an overview of how militaries are using advanced technologies like artificial intelligence to develop new defense machines and strategies, how missiles use it in the various subsystems such as command and control systems, guided weapons and navigation systems, and the drawbacks of using artificial intelligence in missile subsystems.**

Keywords—Artificial Intelligence, Missiles, Military

I. INTRODUCTION

The various combat platforms around the world are looking to incorporate "artificial intelligence", which is the new buzzword. Thus, the platform can make and take decisions on its own and can self-control, self-regulate and self-actuate by using inherent computing and decision-making capabilities. We are already seeing how smart systems are taking over our daily activities and aiding us in performing our tasks in a much easier way, and the advancement of these systems is so much and it just keeps getting better every day. Take for example the AI developed by Google which plays chess – it defeated the chess world champion in record time. Thus, there is a lot of scope in this field of study and if incorporated in the defense industry, it would reap massive benefits.

Now the reason the enlightened prince and the wise general conquer the enemy, whenever they move, and their achievements surpass those of ordinary men, is foreknowledge —Sun Tzu, The Art of War(1)



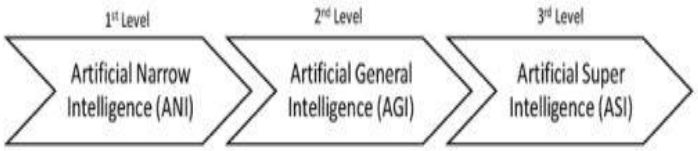
II. THE CONCEPT OF ATRIFICIAL INTELLIGENCE

There are three major waves of AI:

1) Handcrafted Knowledge
2) Statistical Learning
3) Contextual Adaptation

As the technology kept advancing, we were shifting from one wave to the next, and thus have such complex systems. Each wave had improvements on the previous one and was more advanced.

To further understand how artificial intelligence is used, we can classify it into three types:



1) Artificial Narrow Intelligence (ANI)

In this, the computer system collects the data and performs the analysis of this data on its own, thus removing the need for the complex calculations and tasks to be done by humans.

One simple application of this is any weather prediction software, which collects all the data and gives the weather prediction over the course of the week after critically analyzing the data.

Military applications include usage in the tracking and navigation system, where data is fed in real-time, and immediate outputs are provided with exact locations and specifics.

It is used mainly in Unmanned Aerial Vehicles.

2) Artificial General Intelligence (AGI)

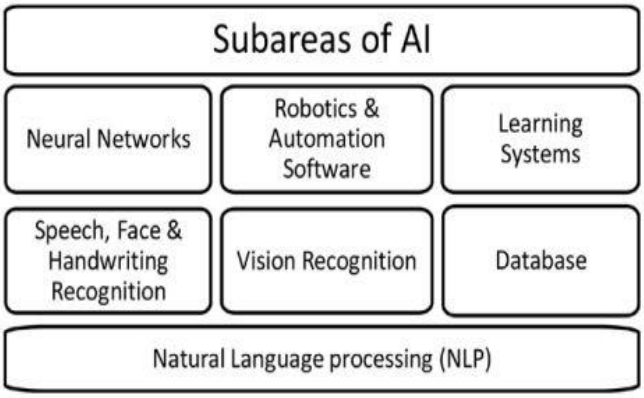
In this, we desire to make the computer system achieve human intelligence.

The system does the basic functions of an ANI system, but also finds a correlation between objects and gathers more

information from various internal neural networks and can hence understand and identify more information.
A good example of this is DeepMind by Google, which is an advanced self-learning system, which uses various machine learning techniques.

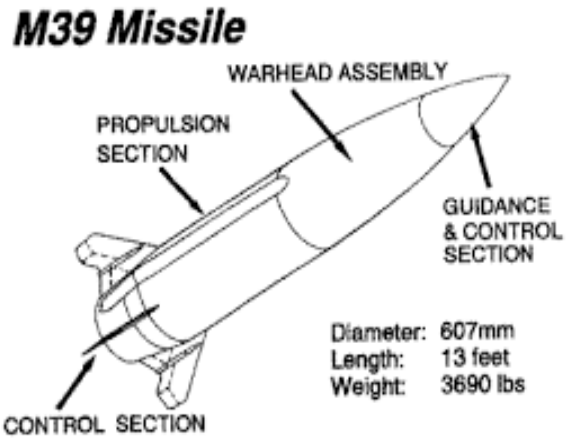
3) *Artificial Super Intelligence (ASI)*
In this, we desire for the computer system to exceed the human intelligence. We still have not reached this stage yet, and it is still in the conceptual phase, but once developed, it'll be the most sought after technology, in all sectors.
But we should first have full trust in such a system as there is potential for it to overthrow the control we humans have on it.

III. DIFFERENT SUBSYSTEMS



Navigation Systems

Most missiles have a separate navigation system, also known as a guided missile system, and the main purpose of this subsystem is to ensure the missile is locating the target and navigating towards the target with utmost accuracy. The position of the target keeps changing every split second, and thus there is a lot of data to be processed and accordingly, the missile will reposition itself on the right path.



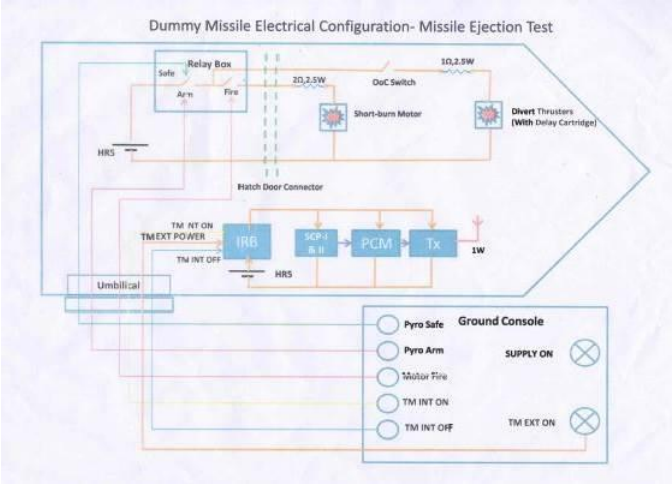
In heat-seeking missiles, heat sensors are used to identify movement of the target, but various defense mechanisms can be used to fool the missile, such as deploying flares to divert the missile. We can replace these heat sensors with an artificially intelligent system which can process data in real time and can hence navigate in a much more efficient way.

One good example of such a missile is the recently developed Amogha-II AntiTank Guided Missile System which was developed by Bharat Dynamics Limited, which uses this new kind of navigation system.

Weapons Targeting Systems

When missile warfare is taking place, we can base the whole model on a complex differential game, which can easily be analyzed by various artificial intelligence techniques. Most missiles are either medium-range or long-range area of targeting, and have different methods of firing.

When the missile is in flight and locking in on the target, many sudden distractions can occur, and it will take time to reset the measures and lock in again, and thus modern missile targeting systems are using smart devices and systems to do this work for them, as this new smart system will already take all these disturbances into account before finally locking in to the target.



In the missiles, in the transponder section of the telemetry system, we can replace the logic circuitry with the new smart system.

Unmanned Systems

Unmanned systems are used in Unmanned Aerial Vehicles (UAVs) and Unmanned Ground Vehicles (UGVs), and these are generally used gather military intelligence about the rivals. These systems must have a very good real-time communication system to relay information to the home servers without any lag or problems, and thus use complex yet easily disguisable circuitry.

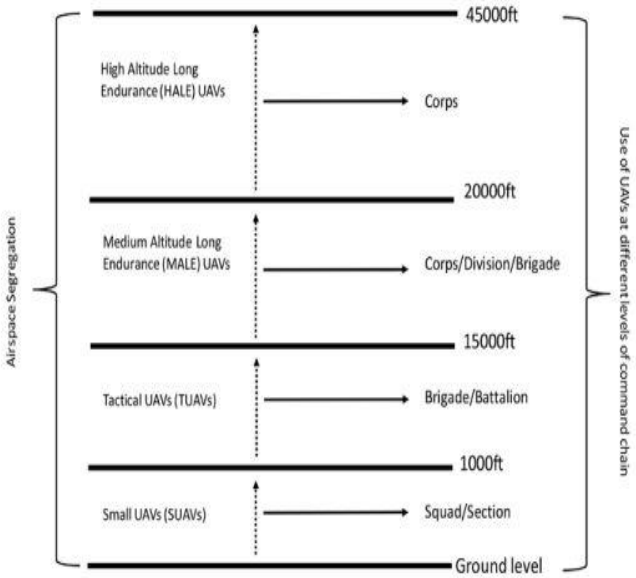
Artificial Intelligence systems can be used to make the sending and receiving of data much easier and will thus improve the efficiency of such a system.

The Indian Military's first foray into this field was back in the 1990's when they developed "Nishant", an indigenous UAV which worked on radio frequency link technology.

Intelligence, Surveillance & Reconnaissance (ISR) ops	Target Location & Designation	Electronic Warfare	Counter Deception
Communication/Data Relay	Combat Search & Rescue	Weapon Strike	Nuclear Biological Chemical Reece
Battlefield Management	Mine Detection	Digital Mapping	Covert Sensor Insertion
Information Warfare	Border Patrol	Logistics	Explosive Ordnance Disposal

Above are the various roles played by unmanned systems.

UAVs have certain air-space segregations, and have be deployed at only certain heights for certain functions. There are certain Micro UAVs which are known as Small UAVs which are used for stealth missions and thus are very handy.

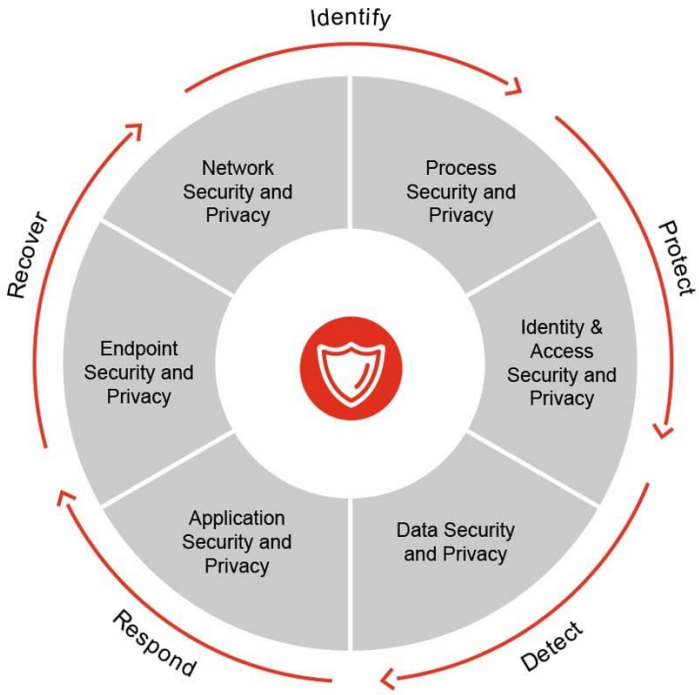


Cyber security

With all the advancements and innovations that militaries come up with, it is highly important to keep their information top-secret, and hence having proper cyber security is also necessary, and hence the use of artificial intelligence systems to enhance their cyber security is the recent trend.

Many military organizations have tie-ups top cyber security providing agencies, and these deals are worth many millions of dollars, because they want to go the extra step to prevent hackers from accessing their data and to prevent data breaches.

Protecting data is not an easy process and requires a lot of human proof-reading when looking at potential data threats and breaches. In a certain case study, a software was developed by Cylance, which could detect malware in the network and neutralize it. But apparently, it required almost 150 hours of human work to be put in every week, and hence they came up with a new artificial intelligence network which would do all the tasks on its own, and hence there was lesser of human dependency, and more of just human surveillance.



IV. Drawbacks

Despite seeing so many benefits of using artificial intelligence in the military and various missile subsystems, it comes with certain drawbacks and is not always ideal. Some of these include the cost of making an intelligent system – it is a very costly process. Also, no matter how much of technological advancement occurs, we can never fully replicate human intelligence. Most of the artificial intelligence systems might not work appropriately if the target is not clearly visible or if there is any cloud obstruction, and thus may cause malfunctions.

Apart from this, there is the everlasting debate about how safe these smart systems would be, and many authorities believe that we should not fully put the hopes of our defense sector in the hands of a technology which we still do not know much about, as things could go out of our hands in the case of an emergency.

V. Conclusion

Artificial Intelligence has been around for a long time, but it is still a field which keeps developing by the minute, and there is a lot of scope for advancement. Using it in the field of missile technology will bring about a lot of technological advancements and being such an important sector where the central government invests so much money, we can improve it even more by inculcating artificial intelligence and thus taking our defense sector to the next level.

Since it is a relatively new field, certain precautions must be taken, and a lot of research and development must go into it.

VI. REFERENCES

1. Gary Chapman, “An introduction to the revolution in military affairs” (in XV Amaldi Conference on Problems in Global Security, Helsinki, Finland, September 25–27, 2003).
2. Sun Tzu, The Art of War (New York: Oxford University Press, 1963), p. 144.
3. Alan Turing, “Computing Machinery and Intelligence,” Mind vol. 59, no. 236, 1950, pp. 433–460.
4. Paul Mozur, “Google’s AlphaGo Defeats Chinese Go Master in Win for A.I.,” New York Times, https://www.nytimes.com/2017/05/23/business/google-deepmind-alphago-go-championdefeat.html, accessed on August 07, 2017.
5. Stephan De Spiegeleire, Matthijs Maas and Tim Sweijs, Artificial Intelligence and The Future of Defence, 1st ed. (Hague, Netherlands: The Hague Centre of Strategic Studies, 2017), pp.12–13.
6. . Vijipriya D. Jeyamani, Jammi Ashok, and S. Suppiah, “A Review of Significance of Sub Fields in Artificial Intelligence,” International Journal of Latest Trends in Engineering and Technology vol. 6, no. 3, 2016, pp. 542–546.
7. Department of Defense (US), “Network Centric Warfare,” 2001. http://www.dodccrp. org/files/ncw_report/report/ncw_main.pdf
8. Shutzer, D., Artificial Intelligence - An Application Orientation Approach, van Nostrand Reinhold Company, N.Y., 1987.
9. Noy, I. and Shinar, J., "Medium-Range Air-to-Air Combat with Undetectable Missile Firings ", 29th Israel Annual Conference on Aviation and Astronautics, Feb. 24-25, 1987.
10. Boulanin, V. and Verbruggen, M., Mapping the Development of Autonomy in Weapon Systems (SIPRI: Stockholm, Nov. 2017), p. 38.
11. Kelly, H.J. and Lefton, L., ”A Preference-Ordered Discrete Gaming Approach to Air-Combat Analysis", IEEE Transactions on Automatic Control, Aug. 1978
12. D.P. Groth, K. Streefkerk, "Provenance and Annotation for Visual Exploration Systems", *Visualization and Computer Graphics IEEE Transactions on*, vol. 12, no. 6, pp. 1500-1510, 2006.
13. Manu Pubby, “DRDO’s Two-Decade-Old Nishant UAV Programme Crashes; Indian Army cancels further orders,” The Economic Times, November 17, 2015, http://economictimes. indiatimes.com/news/defence/drdos-two-decade-old-nishant-uav-programme-crashesindian-army-cancels-further-orders/articleshow/49809095.cms, accessed on August 19, 2017.