Research on the Future War Driven by Big Data

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Abstract. In the future wars, data will become a new engine that changes the formation of war. The paper has expounded the conceptual connotation of future war formation, analyzed the characteristics of future war driven by big data and the big data driven demand in the future war. It will help lay a theoretical foundation for promoting the wide application of big data technology in the military field.

1. The Concept of Future War Formation
Future war formation is not a general and highly generalized concept. It can be concretely revealed by the elements which support the progress of the war. Looking back on the history of the world's military revolution, combat mode, weaponry, and science and technology are the three major elements that support the progress of war. Especially the invention of the disruptive science and technology makes the greatest impact on the formation of war. The application of disruptive science and technology in the military field can not only spawn new weapons, but also promote the development of military theories and combat mode. And combat mode is the most direct manifestation of war. Therefore, new combat mode, new equipment, and disruptive science and technology are mutual coupling to jointly portray future war formation.

![Diagram of Future War Formation](image_url)

**Figure 1.** Components of future war formation.

In the coupling relationship, disruptive science and technology is the direct reason for spawning new equipment, the cornerstone of the future war formation, and the key factor of winning the future war. This paper takes a study on the application of big data driven in future wars. The application and development of big data technology in the military field is of great significance for rapid acquisition of battlefield intelligence and making scientific decision in combat operations. It is a new commanding...
height to gain superiority in the battlefield, and can be called the "virtual combat staff" of the future military.

2. Features of Future War Driven by Big Data

(1) It requires massive data storage capacity. The massive data storage is the premise and foundation of future war driven by big data. There are two reasons for this. First, the ground sensors are widely distributed, the number of reconnaissance satellites and aircrafts are increasing, and people’s network activities and “data footprints” are also increasing, which have made acquiring data from multiple dimensions and perspectives possible. Second, command information system almost generate new data all the time. These data increase in geometric multiples, which aggregate to form a huge data stream. All these require command information system to have stronger storage capacity than ever before.

(2) It requires big data technology to support. Due to the wide range of military data sources in future wars, the military data is of huge amount, diverse formats and low value density. It needs to use big data technology to collect, organize, clean and converse the data of different structures, and generate a unified data view that can be queried and analyzed. Though data analysis, data mining, and deep learning, the valuable data information and other information hidden in objective data can be extracted, and it can meet the command requirement of timeliness, accuracy, efficiency and predictability to data.

(3) It requires to make judgments on command and control decision-making based on data. In the traditional warfare, due to the limitations of information mastering and information cognition, when the intelligence analysts and commanders spend time on analyzing the intelligence information, battlefield situation, command and control decision, and effectiveness evaluation, their prior in formation and empirical knowledge always play an important role. In the data driven future war, decision-making completely relies on the data. The massive data information is processed from the bottom up, analyzed by a comprehensive way, which can avoid the interference of subjective factors, and improve the objectivity, timeliness and accuracy of command and control decision-making.

(4) It makes the command and control decision-making intelligent. Intelligence is one of the most important features of future wars. In the future war driven by big data, the massive military data can be analyzed, mined and learned, and the battlefield situation can be in-depth simulation and prediction, which will provide decision makers with a global development view for combat missions. In the future wars, big data driven command and control decision-making should be used as an important part of the operational decision-making process, and provide support for the formulation of the final plan.

3. Big Data Driven Demand Analysis of Future Wars

The number of military sensors, reconnaissance aircraft, reconnaissance satellites, and the "data footprint" of various activities on the Internet and the Internet of Things are increasing every day. If we use the traditional information processing method, we can’t finish such large and complex work immediately and quickly. Only by using big data technology can the analysis, processing, and mining of massive data be realized. In the future war, the data driven operation mode will run through various operational operations such as intelligence acquisition, strategic early warning, combat decision-making, combat simulation, and combat command.

(1) Demand for "intelligent intelligence acquisition". Expanding the sources of intelligence and digging up more valuable information are crucial to winning wars. The development of big data technology provides new opportunities for intelligence acquisition. With the help of computer’s efficient running speed, accurate algorithm model and cloud storage technology, the information acquisition channel can be expanded, which will help us to collect the data related to combat operations, combatants, equipment performance, such as combatants’ browsing records, search records, communication records, rest time, and so on. Excavating the value information hidden behind the data could provide comprehensive and accurate data support for combat decision-making. Though the big data technology, the massive intelligence data can be processed real-timely, fast and automatically, which can help shorten the acquisition time of intelligence information, and win the time surplus for our own pre-decision deployment.

(2) Demand for "intelligent early warning". After long-term development, China has established a comprehensive strategic early warning system, covering land, sea, air, and sky. However, due to the lack
of early planning, most early warning systems were decentralized and established by various arms and services, which made the early warning system divided and the functions repeated. Thus it could not meet the needs of building an integrated strategic early warning network system. The introduction of big data technology can eliminate the impact of the inconsistency of early warning data technology standards, integrate data information from strategic early warning systems of different services and arms, realize integrated strategic early warning, and intelligently form early warning solutions for decision makers referring. On the other hand, it can also expand the early warning dimension. Using predictive reasoning and data driven models and technologies, we can develop strategic early warning tools aiming at cyberspace, which can real-timely monitor Internet big data, and dig out important clues about terrorist activities and hotspot conflict, and improve the strategic early warning capability of cyberspace.

(3) Demand for "intelligent decision-making". Opportunities are fleeting. Rapid response, accurate judgment, and efficient decision-making are the keys to winning wars. With the battlefield environment rapidly changing, the intelligence information more complicated, and the equipment of powerful enemy more advanced, commanders cannot rely on traditional intelligence analysis methods and decision support methods to make timely, accurate, and effective responses and judgments. It needs more advanced decision-making model and technical means. The data driven decision-making mode can realize comprehensive, instant, fast and accurate analysis of intelligence data, and avoid cognitive bias, cognitive lag and judgment errors, caused by factors such as incomplete information of decision makers, information transmission delay, and subjective experience interference. Thereby the scientificity and effectiveness of decision-making will be improved.

(4) Demand for "Intelligent simulation". Combat simulation is an important tool for combat training and wartime plan formulation. It can not only help commanders and staff officer conduct daily training in a virtual battlefield environment, but also help evaluate the combat plans and performance of weapons scientifically. In the future wars, battlefield environment, weaponry, and technical means are more complex. The combat simulation faces new challenge. Compared with the traditional combat simulation, the advantages of big data driven combat simulation are main in the two following aspects: First, the intelligence data is richer. It includes all data information related to combat operations, such as technical data, training data, tactical data, geographic environment data, interference condition data, battlefield real-time data, etc. And it makes the simulation results more realistic. Second, the algorithm model is more scientific. Big data driven combat simulation makes full use of various algorithms such as data analysis, data mining, machine learning, etc. So it can dynamically adjust the simulation data and simulation model in real time, and be with more predictability.

(5) Demand for "intelligent command". In 2012, the US military proposed the concept of "globally integrated operations", and emphasize the synergy of various forces in operations. The concept of joint operations has aroused the attention of various countries. Due to the military's institutional obstacles, joint integrated operations have been advancing slowly. The application of big data technology in the military field can overcome the constraints of institutional barriers, break the information barriers and data barriers between various arms and services, realize the fusion of intelligence and information, and accelerate the process of joint and integrated operations. In the future wars, the links among the elements of the system's operational command will be closer. Relying on the traditional command network, it is impossible to realize the global awareness of the battlefield situation, the close coupling of the elements of the combat system, the rapid response of combat decisions, and the synchronization of command and control in different places. The big data driven combat model will change the past situation of fragmentation of information resources and decentralized management of command elements. Through big data technology, the intelligence network, communication network, command network and combat unit will be integrated into a new combat command network. It can make the command structure flat and the command mode flexible, which will shorten the time from discovery to operation. It also can realize the unified call, unified organization and unified command of combat resources, and maximize the gathering of combat energy from land, sea, air and sky, electricity, network to form an asymmetric absolute advantage.

4. Suggestions for the Future War Driven by Big Data
In the era of big data, data is permeating all aspects of the military field as an important military element.
How to effectively aggregate big data and use big data technology to drive the transformation of combat mode is the objective need to win the future intelligent war. How to mine valuable intelligence information from massive military intelligence data, promote the efficient and value-added use of military intelligence data, and explore the role of data drives in future wars are serious challenges and important opportunities the military field facing. Therefore, the military should change its thinking mode as soon as possible, fully draw on the development and application experience of big data at home and abroad, and stimulate the potential of big data in future wars.

First, improve the management system and make overall plans for the construction of military big data. In order to realize the unified construction of military big data, the US military has constructed the chief information officer system in the Department of Defense and arms. Its experience and practices can provide reference for us.

Second, attach importance to military big data education, and improve big data driven capabilities for future wars. Whether the construction and management of military big data platforms, or the collection, storage, and analysis of massive intelligence data, it is inseparable from the support role of professional person. The training of big data professionals should be diversified in form, wide in scope, and clear in content levels.

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