The modern cognitive electronic jamming system

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ABSTRACT

In recent years, both electronic jamming and electronic anti-jamming technologies have been greatly developed. Since traditional electronic jamming system is a static interference strategy, it has only several fixed interference modes, resulting the jamming strategy could not be changed autonomously as the environment changes. The COVID-19 virus that broke out in 2020 has spread across the world, causing many people to die. Viruses invading the human body also have the similar function to electronic jamming. In this paper, we transfer the mechanism of viruses invading the human immune system to the field of electronic jamming, achieving a more intelligent autonomous electronic jamming strategy. The new modern cognitive electronic jamming system could realize the real-time situational awareness and make much more intelligent electronic strategy.

CCS CONCEPTS

• **Information systems** → Information systems applications; Mobile information processing systems;

KEYWORDS

Cognitive Jamming, Situational Awareness, Bionics

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1 INTRODUCTION

Nowadays, electronic interference has become more and more important in electronic countermeasures. The electronic jamming system transmits effective signals to deceive or suppress the target by radar. The electronic jamming categories are mainly divided

into blanket jamming and deception jamming^[1]. The blanket electronic jamming usually takes much more high-power noise to the effective signal, causing that the receiver radar can't recognize the effective radar echo signal effectively or even lose the normal working ability^[2]. The deception electronic jamming means that the jammer transmits the signal which with some similar characteristics of the effective radar echo signal to achieve the purpose of deception, resulting the source radar misjudges the false signals as the real target signals when decoding the received radar echo signals. The deception jamming could implement RGPO, VGPO or other jamming strategies to the target radar echo through the DRFM (digital radio frequency memory) modulation^[3,4]. Fig. 1 shows the various jamming strategies in traditional electronic jamming.

The disadvantage of the traditional electronic jamming method is that its jamming strategy is relatively fixed, and the parameters of each jamming strategy cannot be adaptively changed with the external electromagnetic situation. Therefore, much more intelligent electronic jamming methods are particularly important in current electronic countermeasures. Therefore, a brand-new electronic jamming model named "cognitive electronic jamming" is proposed to achieve a more intelligent and adaptive new electronic jamming system.

2 THE COGNITIVE ELECTRONIC JAMMING CHARACTERISTICS INSPIRED FROM VIRUS-INVASION

The SARS-Cov-2 epidemic that broke out at the end of 2019 has already caused many deaths worldwide^[5]. The effective between destruction behavior of the virus to the human body and the jamming behavior of the electronic jamming system to the radiation source radar are same. It is feasible to migrate the characteristics of Virus-invasion to the field of electronic jamming system. Figure 2 is the process of SARS-Cov-2 virus invading the human body which was published in Science magazine^[6].

In Figure 2, the SARS-Cov-2 virus enters the human cells through the ACE2 receptor on the surface of human cell membranes, thereby causing further harm to the human body. At the same time, viruses that enter human cells have a long incubation period. The virus in the incubation period will not cause great harm to people. The virus will launch a violent attack on the immune organs of the human body once the incubation period has passed, and it will cause human being death in severe cases.

Therefore, we summarized three dynamic cognitive jamming characteristics inspired by virus invading the human body:

- (1) With a long incubation period;
- (2) Has a strong ability to infect;
- (3) Able to actively evolve as the environment changes.

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Figure 1: The various jamming strategies in traditional electronic jamming.

- (4) Using the principle of bionics, the virus interference model is migrated to the field of electronic interference, so as to achieve a more intelligent dynamic cognitive electronic jamming system.

3 COGNITIVE ELECTRONIC JAMMING SYSTEM

Compared with traditional electronic jamming methods, the most advantage of cognitive electronic jamming systems is that the new jamming system could interact with the external environment autonomously, so as to be able to use the environmental information to continuously evolve its own jamming strategies and parameters.

The traditional electronic jamming system only has several fixed electronic jamming strategies. Meanwhile, the jamming strategy of the traditional electronic jamming method is static and the jamming parameters change discretely and discontinuously.

Figure 3 is the traditional electronic jamming method which only has n interference strategies. According to the current electromagnetic environment, the electronic jamming system will select one of the jamming strategies as the electronic jamming method acting on the radar radiation source. The electronic jamming system will be helpless once the external electromagnetic environment exceeds the range of jamming capabilities that the jammer can recognize. Therefore, it is very necessary to establish a real-time dynamic

Figure 2: The model diagram of the new coronavirus published in Science magazine.

Figure 3: The several fixed jamming strategies in traditional electronic jamming model

cognitive electronic jamming system. In the dynamic cognitive electronic jamming system, the electronic jamming strategy and the jamming method are dynamically adjustable in real time, and the change process of jamming parameters are continuous.

3.1 Architecture of Cognitive Electronic Jamming System

The most advantage of the cognitive electronic jamming system is that it has the function of autonomously sensing the electromagnetic situation and intelligent decision-making jamming mode. Figure 4 shows the architecture of cognitive electronic jamming system.

In the Figure 4, the electronic jamming system will implement much more intelligent electronic jamming strategies against radar radiation sources when the electronic jamming situation awareness platform has fully sensed and analyzed the external electromagnetic situation. The echo signals from the target and the electromagnetic

environment awareness will send to the electronic jamming situation awareness platform. At the same time, the cognitive electronic jamming system will compare the current electromagnetic situation with the parameters of the previous electronic jamming system, and then makes a more suitable electronic jamming strategy for the current electromagnetic situation, so as to better adapt to the current electromagnetic environment^[7].

Figure 5 shows the interacting process of cognitive electronic jammer and the external electromagnetic environment. The cognitive electronic jamming strategy constantly interacts with the external environment during the process, and its jamming parameters are a continuous changing process.

4 SUMMARY

With the continuous development of intelligent technology, electronic jamming systems have also been greatly improved. This paper uses the principle of bionics to transfer the characteristics of viruses invading the human body to the electronic interference

Figure 4: The architecture of cognitive electronic jamming system.

Figure 5: Cognitive electronic jammer interact with the external environment.

system. The new cognitive electronic jamming system has stronger ability to perceive the external environment, and its jamming strategy is an intelligent system that adapts to the environment. The new system will make electronic jamming system more powerful and intelligent.

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