

REU Site: Engineering research in a liberal arts and entrepreneurship context

Radar Communication Systems and Signal Processing

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Reservoir Computers for Joint Radar Communication Systems:

A reservoir computer (RC) is a branch of machine learning that deduces a dynamical system's state as a time function. Similarly, an RC can generate multiple chaotic signals that are correlated with one another but easily distinguishable. This theory has already been studied for communication systems where the information is encoded and decoded using RC. The next logical step is to utilize the same approach for joint radar-communication systems and evaluate their performance. An RC can detect Doppler effects from moving targets and determine their velocity.

Waveform Design for Integrated Sensing and Communication (ISAC) Systems:

According to the World Economic Forum, ISAC is recognized as one of the top emerging technologies of 2024. For an ISAC system, a single waveform is used for sensing the environment and simultaneously communicating with other devices. In this work, we propose controlling a continuous-time chaotic system to embed information for communications. However, this system is slow, limiting its radar performance. Therefore, we propose modulating (changing the oscillations) the chaotic system using an external discrete-time map, thereby improving the bandwidth of the information-carrying chaotic signal. Additionally, we will investigate the performance of a modulated chaotic signal for the ISAC systems.

[Learn more about Prof. Chandra Pappu](#)