TRENDS IN SIGNAL CLASSIFICATION & DF FOR DEPLOYMENT ON SMALLER PLATFORMS

More data has to be better, surely? Modern militaries live and die by the RF signals that they use. Digital radios used in defense are huge beneficiaries of the technology investments being made in civilian 5G wireless, a considerably bigger user of such devices. This is making semiconductor parts available that have digital modulation bandwidths, resolutions and numbers of channels that vastly increase spectrum visibility. This exponential growth in the creation of digitized data is outpacing the ability of processing devices to do anything with the data. ***Figure 1*** illustrates how manpower to analyze data is not scaling at the same rate as the quantity of data, creating a big gap. To add to the pressure, adversary signals are also growing in numbers and complexity.

As is often the case, technology creates problems, and often provides solutions, also. In this case, ever more powerful processing and Artificial Intelligence (AI) can significantly improve the situation, even on small, lower power platforms such as those deployed on unmanned platforms, Air Launched Effects (ALE), man-packs and the like (see ***Figure 2***).

Why use AI to sift through RF signal data? Traditional digital signal processing (DSP) systems for identifying and locating signals tend to be rigid and require a lot of developer and operator skill. They also take a long time to develop, and are usually slow to respond and update with newly identified signal types as well as expensive. In contrast, AI-based systems are now available that upend this paradigm. Such systems are capable of surveying vast amounts of data and flagging anomalies and signals of interest quickly, even on the smallest platforms, making sure that almost no data is thrown away blindly. In situations where a human operator is available to identify unknown signals that are flagged, library updates can be achieved and deployed within 24 hours to connected platforms.

AI represents a big disruption in signal identification. It can go further, not only identifying interesting types of signals, but also simultaneously estimating the direction of each based on individual and independent time slice samples. It is therefore possible to not only identify a group of Bluetooth bursts, but also identifying that they are clustering at a particular azimuth. The addition of direction finding (DF) brings disambiguation of emitters that greatly enhances situational awareness. Capabilities like these have value on any platform size,

Trends

- More data being acquired, more being thrown away.
- Staffing isn't scaling at the same rate as technology.
- Availability and capability of edge computing, GPUs
- Fast adaptation on the battlefield, evolving adversary signals
- Infrequent/frequency hopping signals

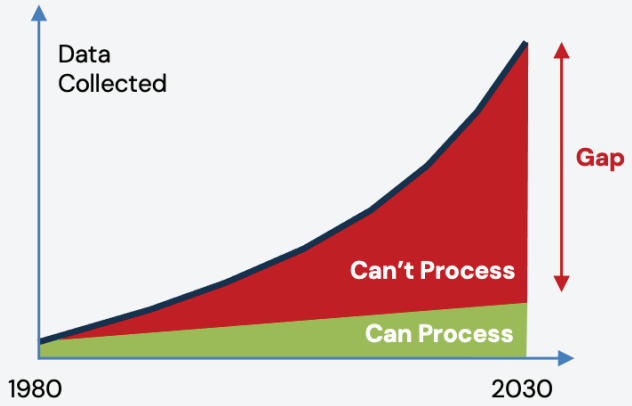


Figure 1: Illustration of the dramatic rise in data being collected which is overwhelming manpower available to sift through it.

AI-Based Signal Processing Advantages

- AI-based signal processing enables true all-spectrum RF awareness
- Process and understand RF signals at the edge
- Detects RF signals 1000x faster than traditional DSP systems
- Gives operators awareness of signals that have never been seen/anomalies
- Monitor several GHz of bandwidth in seconds

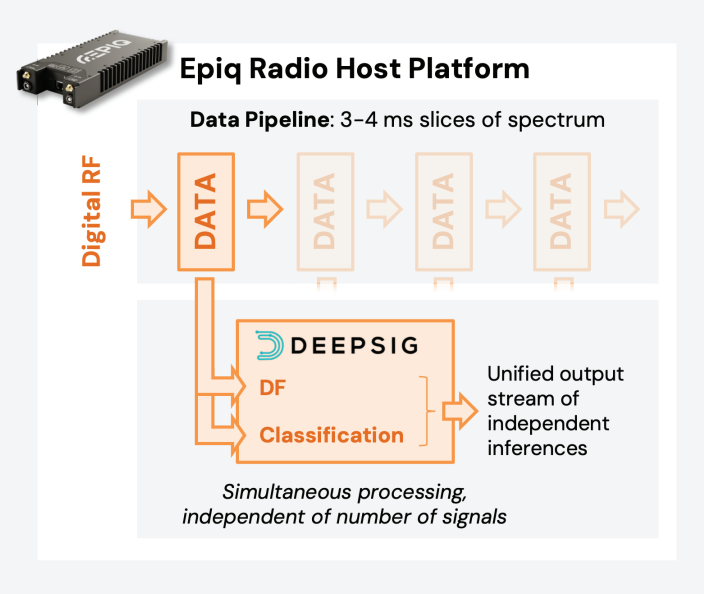
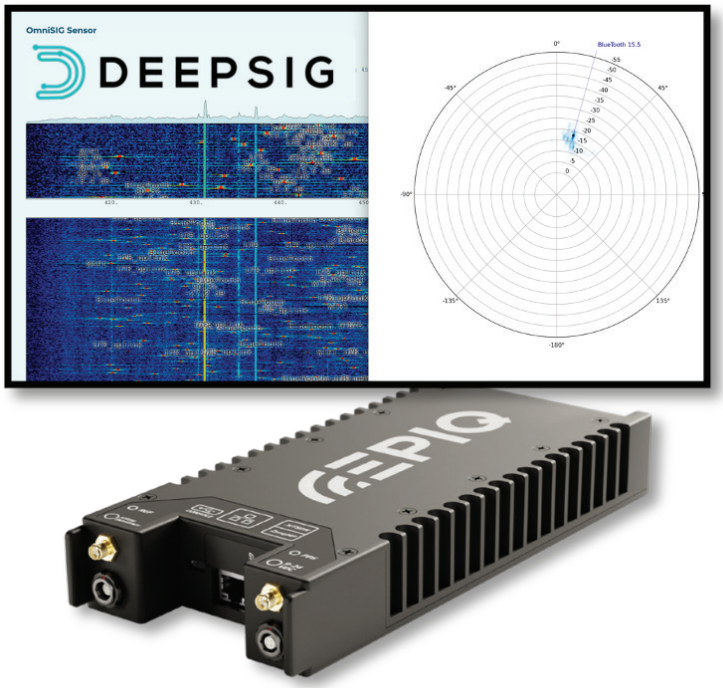


***Figure 3**: Data pipeline of an Epiq radio with embedded GPU showing DeepSig capability to simultaneously analyze and direction find (DF) independent data slices of 20K samples, equating to 3-4 ms of captured RF spectrum data.*

but become particularly powerful when coupled with the latest small form factor (SFF) radios. Such radios often incorporate System-on-Chip (SoC) architectures, which if implemented carefully, can provide excellent linearity and sensitivity, essential characteristics for integration with AI. An example data pipeline is illustrated in ***Figure 3***, which shows AI signal processing of digitized spectral data. AI processing is most commonly performed by a CPU that follows the radio; however, software defined radios (SDRs) are becoming available with integrated graphics processor units (GPUs) that speed up performance by several orders of magnitude and provide processed meta-data output of signal classification and DF in the same data-stream, greatly easing the task of system integration while adding new capabilities to even the smallest assets.

Epiq specializes in SDRs ranging from the ultra-small, all the way up to open standards compliant modular models. We have just introduced the **G20, G40 and X40** SFF models which have integrated GPUs and come with **DeepSig's OmniSIG AI software** pre-loaded. **Contact us** for more in-depth discussions of your unique needs, or visit **our website**. For more in-depth information on DeepSig's capabilities **contact them**, or visit **their website**.

***Figure 2**: Example small form factor applications and domains enabled with Epiq GPU-enabled radios with DeepSig's OmniSIG software.*



ABOUT EPIQ

Epiq Solutions develops cutting edge tools for engineering teams and government-focused organizations requiring situational awareness and detailed insight into their RF environments in order to identify and act against wireless threats.

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