RY19-22

AFRL RESEARCH TOPIC CALL FY19

Research Title: Optimization of RF Sensing & Specificity to the Detection of Sub-threshold Sensory Signals

1. **Individual Sponsor:**

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2. **Academic Area/Field and Education Level:** Electrical Engineering and Computer Science / (MS or Ph.D. level)

3. **Objectives:** A powerful platform to characterize subthreshold signals in noise is a Fractional Cepstrum. The application of this technique to the domain of distributed RF sensing integration is seriously lacking.

4. Description: The approach taken in this proposal is different from published methods by developing the following new techniques for subthreshold signals using a Fractional Cepstrum approach:

(1) The fractional cepstrum problem is cast within the context of a partial differential equation (PDE). The Fokker-Planck Equation (FPE) is also a well-known PDE.

(2) The solutions of the PDEs can be optimized and solved by special techniques. Through the use of the solutions of these PDEs, optimal decision rules and improved RF detection will occur for sensory hardware by the following:
(a) To ***optimize*** RF spectrum detection and decision methods incorporating the Fokker-Planck equation to model time-varying probability density functions.
(b) To develop ***dynamic*** RF detection methods via maximum likelihood decision rules using probability density functions. Such rules enjoy statistical optimality properties.
(c) To ***help obviate*** the current detection problem in sensing systems due to noise.
(d) To ***study the Fractional Cepstrum effect*** within the context of an unknown waveform ambiguity function.

5. **Research Classification/Restrictions:** *U.S. Citizens*

6. **Interest in Summer USAFA Cadet:** No

7. **Eligible Research Institutions:** *Place an X in all that apply.*

x Universities (DAGSI & AFIT) x AFIT (only) x USAFA