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### Research Area: Computational Sciences

In order to maintain its naval dominance, the United States Navy has to constantly improve its methods for remote detection of ever stealthier underwater targets. For coherent detection from a distributed sensor network, the time difference of arrival (TDOA) of the source wave front to each pair of sensors in the network must first be estimated.

#### Specific subtasks:

1. Compute the cross-power spectrum for each sensor pair from their acquired finite-length sampled data sequences;
2. Compute the generalized cross correlation (GCC) under the so-called phase-transform paradigm. The time delay corresponding to the maximum of the GCC for each pair of sensors will provide an estimate of the associated TDOA. Knowing the TDOAs, the coordinates of the unknown source (target or threat) will be obtained using a maximum likelihood optimization procedure.

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