PROJECT TITLE:
Recovering Information from Speckle

PROJECT DESCRIPTION:
Array imaging has many important applications such as radar, ultrasound, sonar, seismic imaging, and so on. In array imaging, a scene is probed by waves, then a collection of receivers record the wave field measurements which are reflected back from the objects in the scene. The goal is then to obtain information about this unknown imaging scene, ideally to reconstruct the image of the scene from these measurements. When the objects in the scene are not localized but composed of many small scatterers then a random noise pattern, which is called speckle, is usually observed in the reconstructed image. In this project, we would like to use speckle (and possibly other noise sources) in order to distinguish a portion of the imaging scene which is different than the rest in some sense. One such application, for example, can be to determine a man-made portion of the scene from the rest. We would like to study and make use of the statistical properties of the random distribution of the above-mentioned scatterers and their effect/signature in the measured wave field data. Some of the relevant works are listed below [1-9]. Simulation parts of this project can be done with an interested REU student. This portion of the project involves building and testing the proposed computational models and comparing their performances with the conventional models. In particular, such an REU project involves reading and communicating research ideas/papers/books, programming the newly developed methods in MATLAB, and preparing test/comparison reports about these models. Although the tasks will be computation intensive, there might be some opportunities for working on modeling and other theoretical involvements afterward (this will depend on the REU student's interest).

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