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(Research Article)
Accuracy and acceleration improvement of Fisher-based infrasound signal detection using Genetic Algorithm

R. Masoomi, H. Sadeghi*
Technical and Engineering Faculty, Imam Khomeini International University

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Abstract

Sound waves with frequencies below the human hearing threshold in the range of 0.002 Hz to 20 Hz, which are traveling through the atmosphere, are referred to as infrasound. Wind is the main noise in the above-mentioned frequency range. The operation of receiving and detecting of infrasound are often hampered by wind. Therefore, high quality detectors are required. For this purpose, sensor arrays and array signal processing techniques are utilized. Fisher ratio-based signal detection is a widely used and powerful method in the field of infrasound. The main drawback of this approach is its high computational time due to the repeated computation of test statistics for each element of the slowness grid. Thus, the researchers use a relatively low-resolution slowness grid in order to save time in processing. On the other hand, low resolution results in an error in the values of estimated parameters of infrasound waves. In this study, a genetic algorithm based detection method is proposed in order to overcome the fundamental problems of the Fisher method. In the proposed method, the slowness grid components (p_x, p_y) are defined as the chromosome for the genetic algorithm. Despite the previous methods, the genetic algorithm has created the advantage that searching could be conducted in a continuous slowness grid. Therefore, the continuity of the network and searching only a limited number of slowness vectors reduce error rates and processing time respectively. The apparent velocity and incoming angles became 0.5923 and 0.0710 respectively, and the processing time decreased considerably from 25835.07 seconds to 533.55 seconds on average.

Keywords: Infrasound, Detection, fisher, Genetic algorithm, Optimization.

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* Corresponding author E-mail: h.sadeghi@mail.ru