

DETECTION OF ELEPHANT INTRUSION WITH SEISMIC
SENSORS AND MACHINE LEARNING

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Name of the supervisor: Dr. M.A.U.K. Premaratne

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ABSTRACT

Human elephant conflict (HEC) is a severe social issue in several Asian countries. A possible approach to prevent HEC is to identify the presence of elephants remotely, thus people can get precautions. This research introduces a method to detect presence of elephants by acquisition of seismic signals generated by their footfalls. A seismic sensor – Geophone was used to convert seismic waves to analog signal and then it is converted to digital domain. Digital signal processing techniques have been used to develop an algorithm that distinguishingly identifies subsequent signals due to elephant footfalls.

Developing such an algorithm was a major objective of the research. A novel algorithm has been developed based relative harmonic contents of the transient signal generated by elephant footfalls. Machine learning algorithms have been used to get the intuition and obtain this algorithm. It uses features of transient signal generated by a single footfall; thus a detection result is generated for every individual footfall. This makes real-time detection possible.

Data acquisition and recording hardware has been designed. Site recorded data was processed and analyzed offline in MATLAB environment with a laptop computer. Development and testing of the algorithm was done entirely in MATLAB. However algorithm was designed to be implemented with much less computational power in a microcontroller. Therefore the electronic systems which will use this algorithm can be fabricated as portable units and they can be used at HEC affected areas to get elephant intrusion warnings.

Algorithms developed with SVM classification and relative harmonics contents could successfully detect elephant footfalls below average time period of 6s; even when high environmental seismic noise is present. This had been lowered to 3s periods when there is less seismic noise. False detection has average periods of 10s or more.

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