In traditional sparse recovery problems, the goal is to identify the support of compressible signals using a small number of measurements. In contrast, in this thesis the problem of identification of a sparse number of statistical changes in stochastic phenomena is considered when decision makers only have access to compressed measurements, i.e., each measurement is derived by a subset of features. Herein, we propose a new framework that is termed Compressed Change Detection. In particular, given a large number N of features, the goal is to detect a small set of features that undergoes a statistical change using a small number of measurements. The main approach relies on integrating ideas from the theory of identifying codes with change point detection in sequential analysis. If the stochastic properties of certain features change, then the changes can be detected by examining the covering set of an identifying code of measurements. Sufficient conditions are derived for the probability of detection to approach one in the asymptotic regime where N is large.

As an application of compressed change detection, the problem of detection of a sparse number of damages in a structure for Structural Health Monitoring (SHM) is considered. Since only a small number of damage scenarios can occur simultaneously, change detection is applied to responses of pairs of sensors that form an identifying code over a learned damage-sensing graph. Generalizations of the proposed framework when multiple concurrent changes happen and for arbitrary graph topologies are presented.

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The public is welcome to attend.