Multi-sensor health diagnosis using Deep Belief Network based state classification

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Kansas is one of the headquarters of major aircraft manufacturing industries. Due to large human life risks involved in flight journey, safety and operational reliability of aircraft is more critical. This research proposes a novel multi sensor health monitoring and failure diagnosis for Kansas industries to manufacture most reliable and failure preventive aircrafts to the world. Aircraft reliability depends on continuous monitoring of current system health status and health state detection is a key factor for prevention of performance degradation at different stages of damage. Due to nature of observed data and the available knowledge, health diagnostic methods are often a combination of statistical inference and machine learning. A novel artificial intelligent technique, Deep Belief Networks (DBN), has been quite effective in some applications such as image recognition and audio classification with promised advantages such as fast inference, fast learning, and the ability to encode higher order networks. This paper proposes the use of DBN for structural health monitoring applications of aircraft and develops multi-sensor health diagnosis method. DBN works based on Restricted Boltzmann machine and it learns layer by layer considering priors and network posteriors. Enhanced diagnostic system can be structured in three stages: first, collection of data from different sensors and preprocessing of the data; second, development of DBN classifier model based on nature of the system; third, training of DBN with data for different possible health states of the system. Classification effectiveness of this network is evaluated using experimental data for various real time practical conditions.