Classification of Domestic Burning Smell using Covariance k-Nearest Neighbour Algorithm for Early Fire Detection Application

Abstract

Fire is one of the most common hazards in households. It is the fifth leading unintentional cause of injury and death, behind motor vehicle crashes, falls, poisoning by solids or liquids, and drowning. It also ranks as the first cause of death for children under the age of 15 at home. Roughly, 80 percent of all fire deaths occur in places where people sleep, such as in homes, dormitories, barracks, or hotels. 74% of the deaths result from fires in homes with no smoke alarms or no working smoke alarms while surveys report that 96% of all homes have at least one smoke alarm. Nearly all home and other building fires are preventable. No fire is inevitable. Determination of burning smell is important because it can help in early fire detection and prevention. This preliminary study discusses the development of a fire sensing system that is not only capable of detecting fire in its early stage but also of classifying the fire based on the smell of the smoke in the environment. A domestic burning smell classification system for early fire detection application has been proposed using new covariance k-nearest neighbour (Ck-NN) algorithm. The experiments were performed on recorded smell samples from combustion of ten different commonly available domestic odour sources, including candle, joss sticks, air freshener, mosquito coil, newspaper, card board, plastic materials, Styrofoam and wood. All the experiments were done in a test chamber with humidity and temperature sensors. Portable Electronic Nose (PEN3) from AirSense Analytics is used as the measurement device. The smell source is placed 0.3m from the PEN3 and the time-series signal is measured for two minutes. The odour metrics consist of 66000 odour samples are modelled using Ck-NN algorithm. It is found that the average mean classification accuracy for the model is 99.63%.