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Adaptation of ANFIS model to assess thermal comfort of an urban square in moderate and dry climate

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Abstract Attractiveness of the open urban spaces, such as plazas or squares, depends on the visitor's thermal comfort. In this respect, it is important to assess the environment of such open space along with the demographic factors of the visitors. This study used the soft-computing method of adaptive neuro fuzzy inference system (ANFIS) to investigate the thermal comfort of visitors at a public square in Iran during hot and cold weather conditions. The ANFIS process for variable selection was implemented in order to detect the predominant variables affecting the individual's comfortable feeling. Model's training and testing data were collected through the field measurement and survey during hot and cold times of the year. We used 18 input parameters, representative of demographic and environmental factors, to compute visitor's thermal sensation, comfort feeling, and 4 common indices, namely the mean radiant temperature (T_{mrt}), mean physiological equivalent temperature (PET), standard effective temperature (SET) and predicted mean vote (PMV). The results indicated that among the examined factors, the air temperature (T_a) is the most influential parameter and best predictor of accuracy for the individual's comfort feeling at the studied urban square. The results show that T_a can best predict the common indices of outdoor comfort, namely the PMV, PET, SET, thermal sensation, T_{mrt}, and comfortable felling compared to other parameters with the least error of 1.94, 18.87, 13.67, 0.91, 7.80, and 0.34 %, respectively. Some of the main advantages of the ANFIS scheme are that it is adaptable to the optimization and adaptive methods, and is computationally efficient.

Keywords Outdoor thermal comfort · Comfort tool · ANFIS · Variable selection

1 Introduction

The outdoor thermal comfort determines the activities of pedestrians in public outdoor spaces (Kariminia et al. 2011; Chen et al. 2014). Weather conditions of the open spaces determine the amount of visitors and their level of comfort feeling. Amelioration techniques encourage people to stay outdoor in hot summer days with provision of shaded areas or places having cool environment through the water circulation (Yue et al. 2014; Kim et al. 2011). In contrast to summer, during cold winter days, visitors prefer the sunlight and their discomfort increases with the high-intensity cold wind that limits usage of such open places (Bayraktar et al. 2010; Singh et al. 2010; Deb and Ramachandraiah 2010; Xie and Fan 2014).

Global warming has affected the outdoor environment and visitors' level of comfort in open urban spaces (public park, plazas and squares) under extreme weather conditions

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