Performance of the nested k-means method for detecting persons in aerial photographs taken in severe winter conditions by an unmanned aerial vehicle

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The nested k-means method aims to automatically identify places in a geographical space where objects that resemble human are likely to be present. The method has been tested on aerial visible-light (RGB) images acquired by an unmanned aerial vehicle (UAV) during an extensive observational campaign in the Izerskie Mountains (south-western Poland) in dissimilar conditions: different periods of a day, different land cover and with/without snow cover. Although the initial tests revealed considerable skills of the nested k-means method in automatic identification of persons in the wilderness, further studies are needed in order to confirm its usefulness. The present paper focuses on the use of the nested k-means method to locate person-like objects in UAV-acquired aerial RGB and near-infrared (NIR) images taken during severe winter. We take use of photographs of terrain covered with snow, on which persons wearing the same clothes were present in the same locations, taken in dissimilar meteorological situations (approximately from $-12°C$ to $-1°C$). The objective of the study is therefore to check if severe weather influences the performance of the nested k-means method. Having focused on a single person, the location of which was identical over all photographs taken in different environmental conditions in the winter 2015/2016, we re-run the automatic identification procedure based on the k-means method on images taken: with RGB camera, with NIR camera, when a person was exposed to severe cold, and when a person was exposed to mild winter conditions. We found that the approach serves well the purpose of identifying persons. In addition, we calculated a few statistics (detection rate and over-identification rate) as a function of the above-mentioned four cases.