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A combined approach between Convolutional Neural Network and optical flow for the assessment of wave and tide parameters on the Mediterranean and Atlantic coasts

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Coastal monitoring is a continuously developing topic, which has been addressed in several ways. Among the different techniques, the coastal video monitoring together the recent machine learning and computer vision techniques have become widely used to evaluate the meteo-marine features. On the other hand, the video monitoring allows to obtain a large amount of data spatially and temporally well distributed on the coasts. The video records allowed to obtain a series of continuous frames where tide phases, wave parameters and storm features are clearly observable. In this work, video records of the Mediterranean coasts have been acquired through the surveillance cameras located in the proximity of south-eastern Sicily coasts (Italy). Tide, wave and storm parameters were assessed through a combined approach between Convolutional Neural Network (CNN) and optical flow techniques. Tide phases and storm surge were obtained through CNN classification techniques, while optical flow techniques were used to assess the wave flow and wave height impacting on the coasts. Neural network predictions were compared with tide gauge records, while, the water level and wave height were validated through spatial reference points obtained from topographic surveys in the proximity of surveillance cameras, so to improve the agreement between network results and field data. The goodness of the results was evaluated through a Root Mean Square Error analysis and by evaluating the correlation coefficient between results and field data. Subsequently, CNN and optical flow were applied on the Atlantic coasts of Portugal through action cameras, in order to show the difference in terms of wave flow and wave height respect to the Mediterranean coasts. The application of CNN and optical flow techniques allowed to automatically obtain the marine insights and to increase the amount of data that usually are not densely distributed along the coasts.