USING MICROSOFT AZURE COGNITIVE SERVICES FOR FLOOD RISK CLASSIFICATION

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Abstract. We propose an approach for a swift classification and categorization of camera photo frames of a flood-prone coastal area using Microsoft Azure machine learning cognitive services. As part of a multi-source integrated flood risk assessment platform, we compare it with another machine learning approach.

Keywords*:* Microsoft Azure, machine learning, cognitive services, automatic detection.

1. INTRODUCTION

The Portuguese coast presents a high risk of flooding that is increasing with the sea level rise [1]. To improve the response capability to these events, the understanding of the hazards, vulnerability and exposure of people and assets should be integrated in efficient methodologies that improve planning and response to emergency. The MOSAIC.pt project aims at developing a methodology that 1) improves the flood prediction in different coastal typologies, through the integration of data from multiple sources, and 2) identifies the coastal typologies most affected by flooding which will support the development of an integrated risk analysis methodology [2].

This methodology combines several hydro- and morphodynamic models to determine wave propagation at a beach scale with a real-time monitoring network that includes remote monitoring cameras. In terms of remote monitoring, these cameras are being used for the detection of specific water-related boundaries. This detection is currently done through a bundle of Python scripts by applying data science specific techniques to sets of images.

Herein, we present and assess an alternative approach for this remote detection using Microsoft Azure cognitive services. The proposed solution will be compared and, simultaneously, fed by the other machine learning approach that uses expert knowledge to detect the water boundaries in a beach area. This approach will be validated in the future with the application of the Microsoft Azure cognitive services, in recognizing and classifying stationary camera frames of one of the MOSAIC.pt case studies sites.

2. CLOUD-BASED APPROACH

2.1 Current approach

The machine learning approach [3] currently in place uses the data extracted from the project multiple sourced information from conventional and low-cost fixed stations, remote sensing from stationary cameras, satellites and unmanned aerial vehicle-UAV, and model-based forecast systems. Based on the resulting data originated in these sources and expert knowledge on the case study site, a set of scripts were developed in Python in order to detect the intended water boundaries. These scripts apply several techniques on the high-resolution frames generated by the deployed stationary camera (Figure 1). In the first part of Figure 1 (a), we are able to view a single frame of the camera showing the beach scenario (both sand and ocean are clearly visible). In Figure 1.b) we can observe the result of some of the procedures executed in the mentioned scripts. A mask was placed over the static and non-relevant parts of the camera frames and an average of a group of 10 frames related to 20 seconds of footage was created. Finally, on the third part in Figure 1 (c), a sample of the detected lines is illustrated. These scripts automatically detect the relevant water boundaries.

2.2 Cloud-based Framework

Our proposed cloud-based approach uses Microsoft Azure's cognitive services to automate and provide a real-time (fast) classification of the images generated from the stationary camera. This approach is intended to be applicable to any coastal system and to be used as a detection mechanism for an ongoing flood event. Therefore, it has to be able to cope with the specific requirements of performance and viability to real-time monitoring.

The cloud-based framework is divided in two parts (Figure 2): the local server procedures and the cloud-based ones. In the mentioned figure, arrows 1.a, 1.b and 1.c refer to the procedures currently in place. These are necessary because their outcomes will feed the database storage that will support the required cognitive training process. The cognitive services are able to detected objects or shapes in images, according to a determined set of features identified in the training images dataset. If done from scratch, we would need to identify on each frame the relevant visual aspects, which would be a long and difficult process. Using the images constructed with the current procedures, we are able to use domain models to detect and identify domain-specific content of the camera frames.

Once the training process is finalized, we will be using only the Cloud-based procedures to promote the intended detection, as identified in Figure 2 by the arrows 2.a and 2.b.

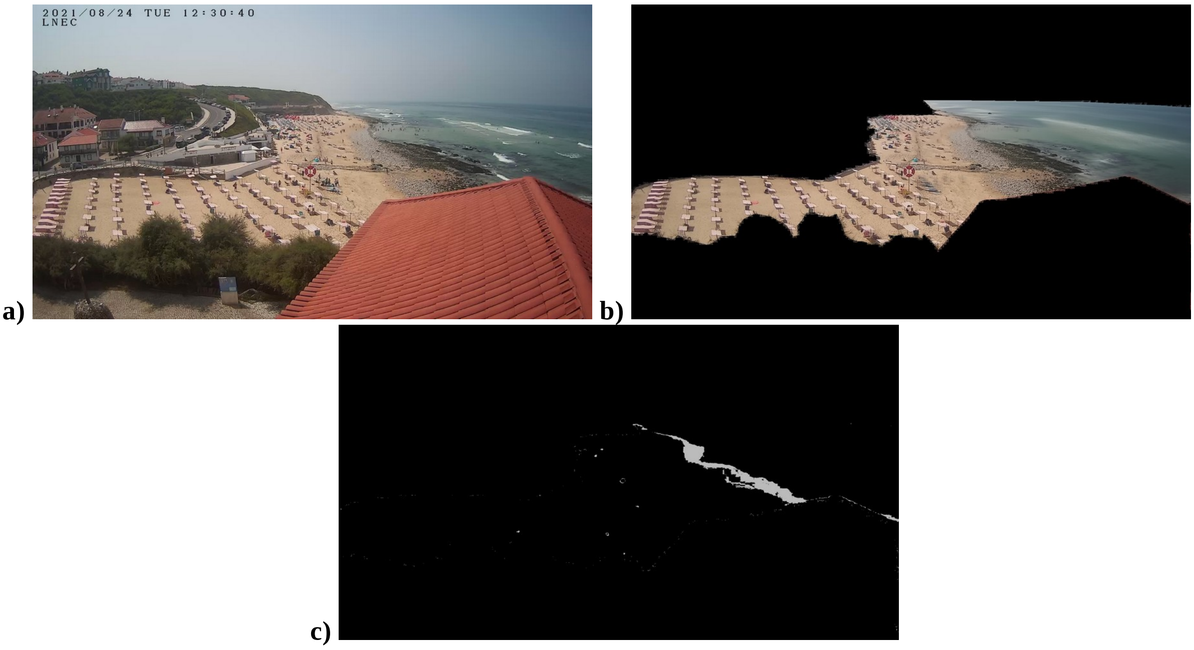

Figure 1. a) Example of a remote high-resolution camera frame **b)** Average image of a group of 10 frames **c)** Example of water boundary detection extracted from the average in b)

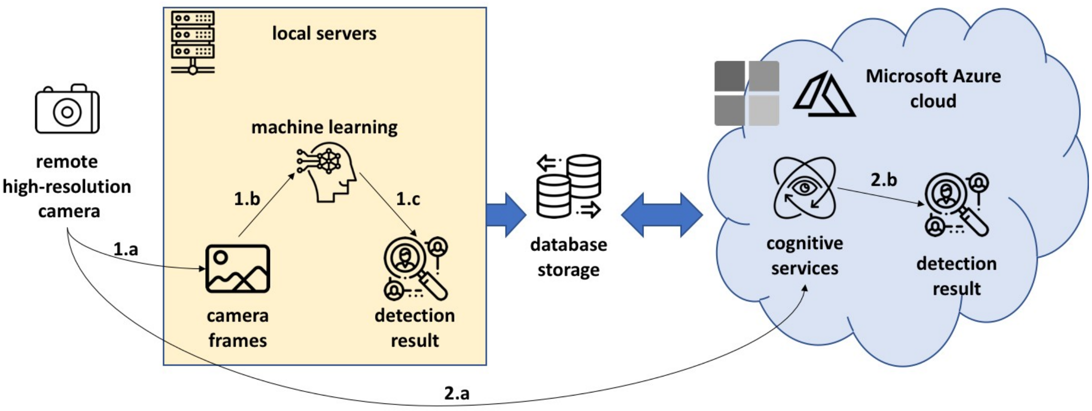

Figure 2. Cloud-based framework

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