Project No.	Project Title	
2022-01-035	Emotion Recognition in Drone Encounters	
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Abstract

The expansion in drone use and in the number of drone use-cases is a direct outcome of the research and developments made in the field. Today drones can be found not only in military use but also in the industry of agriculture, shipments, health, rescue, etc. The expectation for the near future is for more autonomous drones, which will lead to an increase in interaction between drones and humans, even if they are passersby. An autonomous drone that is sent to provide an essential medicine to the patient (for example) - needs to know how its environment responds to its presence and act proactively. To give this ability to the drone, the ability to identify a person's basic emotions is required. The capabilities that exist today in the field of artificial intelligence based on data, can enable us to deal with this problem.

First, the drone will sense the environment with the help of its camera. The resulting image will undergo image processing, in which the computer will identify the person, and will extract the relevant features to the classification of the person's basic emotion. The computer will then run a classifier to classify the person's emotion and send an order to the drone to act accordingly. The goal is to classify an emotion as positive, negative, or natural, as a response emotion that the person feels toward the drone that is in front of him.

In our project, we used a data set of videos taken from a drone's camera, which photographed various passers-by. The videos are divided into frames, in which each person is tagged with a basic emotion. The process first included exploring the relationship between human body gestures and its emotions, which led to choose in pose estimation as an image processing tool to use on the various videos. From these raw data we created a set of features that characterize the responsive emotions of passers-by. On top of these features, we ran a process of pre-processing and handling imbalanced data, selecting the most important features, running machine learning models while adjusting parameters, and performing evaluation and comparison between the models.

Following the process described above, we found that body gesture features better classify human emotions than other visual features while understanding that the ability to classify emotions based on these data and features is limited. We created several classifiers which able to classify the natural/positive/negative emotions at a certain classification level. To continue the process using machine learning tools, more unusual samples must be collected that differentiate the existing labels. To use more complex tools like deep learning, more extensive amounts of data need to be collected.

Keywords: Human-Drone Interaction, Pose Estimation, Machine Learning, Emotions, Classification.