StageUp - A Photo-Challenge Mobile Application

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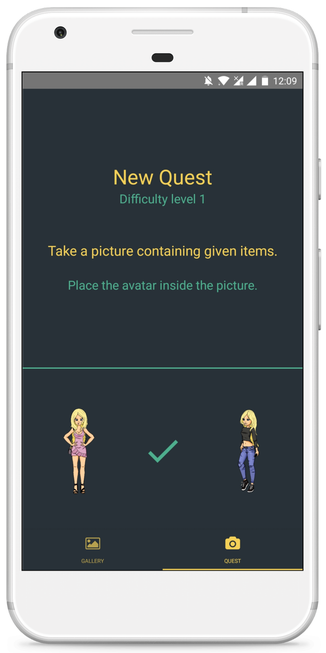
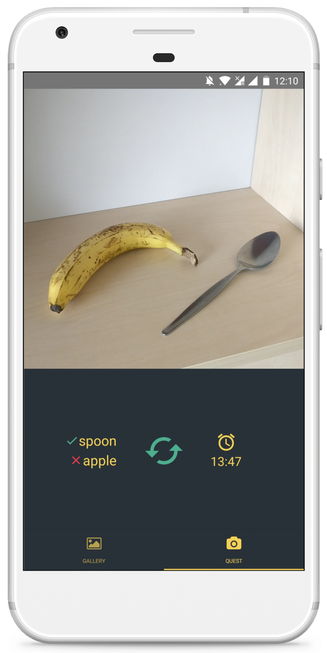
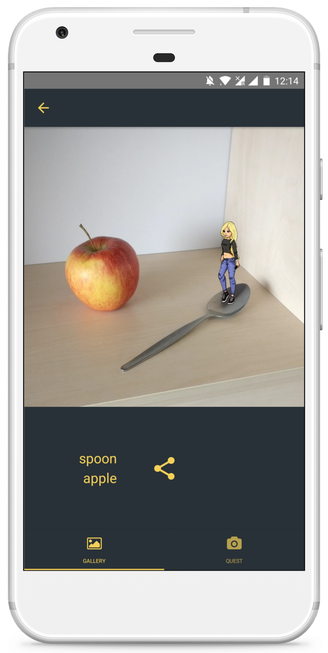






Overview

- A mobile application, that challenges users to take a picture containing given items. Additional features such as animated avatars, time constrains on completing the quests or sharing the image on social media are added to the application, in order to promote playfulness and user interest. The application is designed to have a functionality, which automatically and instantly evaluates the taken pictures. This is addressed as an image recognition problem, and is solved using convolutional neural networks and multi-label classification.

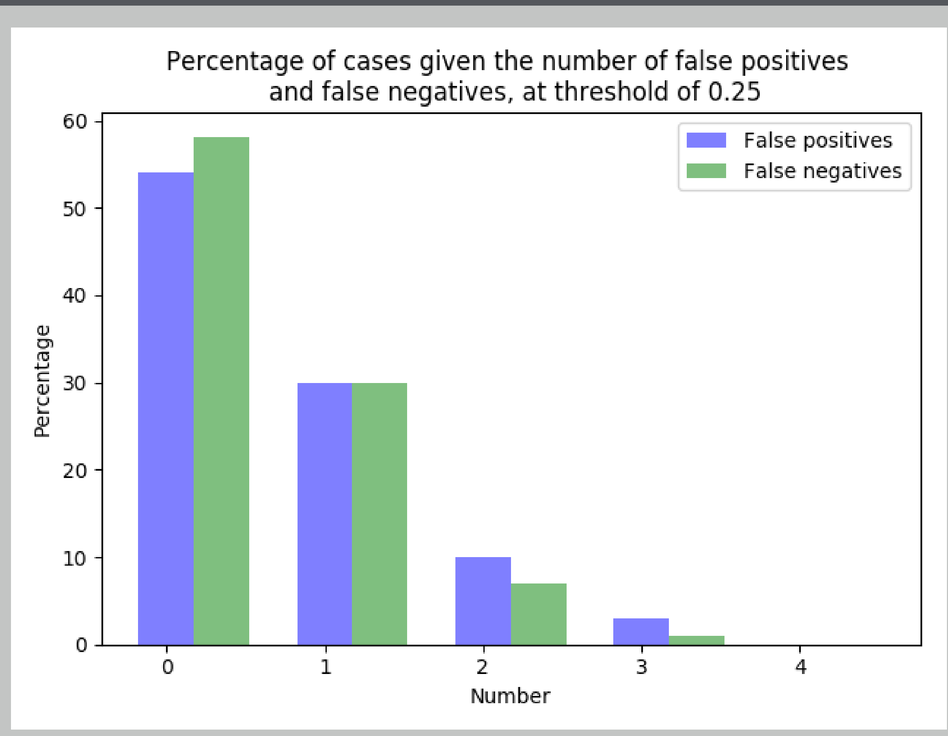
Technical design

- The architecture of the application is based on the client-server model. The client, in this case is the application running on a mobile device, is responsible mainly for taking a picture, communication with the server, and user interaction through the user interface, together with presentation of received data. The image recognition, as well as the functionality that generates and assigns quests to the users, are handled by the server. Another part of the server is the database, which makes the user profiles accessible from any device. The advantages and disadvantages of using this model have been taken into consideration.

Image recognition

- Two different approaches of image recognition have been implemented and considered. These are object detection and multi-label classification, trained on datasets such as The Open Images or COCO: Common Objects in Context. The models used for object detection are Faster R-CNN and Single Shot Detector (SSD), which ended up disregarded, mainly due to their high operation cost. The application ended up using Inception V3 model trained as a multi-label classifier, on 29 classes from COCO dataset.
- The actual usage of application will create a set of images, which can be used to further improve and evaluate the model. With the approval of the users, these images could be published for the community, as a new multi-label image dataset.

Evaluation



- A custom metric has been created, based on the number of false positives and false negatives per image in a multi-label setting. Considering the gameplay of the application, false positive represents the case when the application recognizes the object that is not in the picture, while false negative represents the case when the object is in the picture and does not get recognized. By increasing the threshold, the number of false positives decreases, while the number of false negatives increases. The threshold has been experimentally set to 0.25, where both false positives and false negatives are in the acceptable range. The metric has been evaluated using the multi-label classifier on the validation part of COCO dataset, taking into consideration only the 29 trained classes. Other metrics such as Precision-Recall have been evaluated as well, where the model reached mean average precision (mAP) of 0.69, over all classes.

Acknowledgments

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