COSTA RICA NATIONAL UNIVERSITY

COMPUTER SCHOOL

Proposal of a computer vision algorithm for Apidae Meliponini bees characterization through mobile devices.

Students

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GENERAL INFORMATION

1. TITLE OF THE PROYECT

Proposal of a computer vision algorithm for Apidae Meliponini bees characterization through mobile devices.

2. JUSTIFICATION

Bees are globally recognized as the main pollinators. The pollinating action of bees is proven to be crucial for the plant's cycle, since more than 70% of the 100 crops that provide food for humans are pollinated by bees (Álvarez, 2018).

Due to special characteristics of the species, the Tropical Apiculture Research Center (CINAT) wants to focus the development of this project only on stingless bees, considering the number of species that can be found in the country. According to Chavarría (2015), in Costa Rica there are around 60 species, being scattered throughout the national territory. Due to a drop in the immune system of bees (stinging), hives easily die from diseases, which is why meliponiculture and other alternatives are re-emerging little by little (Meliponicultura, 2015).

The use of this application would serve as the first source of information for people engaged in the trade of crops, since data such as plants from which they feed and in turn pollinate, can depend on the species and region in which they are. Some species of “Trigonas” (species of stingless bee) are used as pollinators of specific crops, managed in the open field, this way produce fruits or seeds (Meliponicultura, 2014). Biodiversity in ecosystems encourages the biodiversity of stingless bee species since there is a relationship between the evolutions of flowers with their native pollinators (Meliponicultura, 2014).

In addition, the mobile application aims to make easier access to the information for CINAT's target users, which includes experts, beekeepers, amateurs and students from related careers, in order to educate and keep awareness of the diversity of bee species that exist in Costa Rica.
Currently, mobile applications have become very useful tools that help us in our daily routine, for example in communication and entertainment, making payments, transactions, see the catalog of products or services and buy them (Castillo, 2016).
There is a change in the use of the smartphones, for example in Costa Rica, according to the study "Uso del teléfono cellular en la población Costarricense" in 2017, it indicates that 94.6% of the interviewed people, use the cell phone, and 85.4% have it with a touch-screen. In addition, the entrance to social networks is a frequent use with 76.8%, which indicates a significant internet demand. (Peña, 2017).

Mobile Internet subscriptions grew by 97.5%, according to Sutel, 4.8 million users in Costa Rica, are accessing the Web through their cell phone (Lamb 2018).

On the other hand, there is a high use of image processing worldwide distributed in a large number of application areas. One example of this is in the field of security, in China, the police use similar devices to Google's glasses to identify potential suspects (Roussell, 2018). It is said that they can identify the suspects by the way they walk. "Passage recognition is a technology that is being used by the Beijing and Shanghai police, where they can identify individuals even when their faces are obscured or they are on their backs in front the cameras" (Roussell, 2018).

In banking, computer vision is used to check transfers remotely by taking a picture of the bill with your mobile phone. The computer vision software in the application captures the photo of the bill, then verifies if the signature is genuine (IoT of all, 2017).

Another application that is currently in development, is the search for lost mountaineers. With the help of drones equipped with cameras, as well as other devices, they intend to scan the entire search area to make a 3D model of it and facilitate the finding of mountaineers. As the drone flies around the area, create a 3D map of the terrain, then algorithms help to recognize sites not yet explored. In a ground station, the different maps of the different drones are merged into a single map that can be monitored by rescuers (Matheson, 2018).

3. OBJECTIVES

- **General Objetive**

Facilitate the detection of *Apidae Meliponini* bees and its different attributes using computer vision algorithms through mobiles devices.

- **Specific Objectives**

1. Analyze the methods of *Apidae Meliponini* bees characterization and its different attributes through computer vision algorithms.
2. Propose from the analysis, a characterization method that uses the computer vision algorithm selected.
3. Implement a computational tool that uses the proposed algorithm.
4. Determine through functional testing the effectiveness of the characterization of Apidae Meliponini bees with the utilization of the proposed tool

- **Tabla de Objetivos**

Objetive	**Product**	**Achievement Indicator**
Analyze the methods of *Apidae Meliponini* bees characterization and its different attributes through computer vision algorithms.	Inputs and knowledge to be applied to the project	Comparable results from the different algorithms used for computer vision. Besides the necessary inputs for the characterization of the *Apidae Meliponini* bees
Propose from the analysis, a characterization method that uses the computer vision algorithm selected.	Implementation of the method using the algorithm selected	Selection and implementation of the algorithm with the highest index of approaching to the *Apidae Meliponini* bees identification
Implement a computational tool that uses the proposed algorithm.	Mobile application and its corresponding manager system	Application and manager system ready to be tested.
Determine through functional testing the effectiveness of the characterization of *Apidae Meliponini* bees with the utilization of the proposed tool	Executed testing plan.	Validation of the results by the sponsor

4. SCOPE

The project scopes the creation of a mobile application to make easier the identification and to get information of the species, this way, the experts users, beekeepers, amateurs and students interested on this area, can use it and do field work. The application will allow either identify the specie that the bee belongs to from *Meliponini* tribe or discriminate and approach the user to the possible closest

range. The initial testing and development will be done to a one single specie only, this way, to verify and validate the identification algorithm.

The necessary inputs to make the discrimination possible, will be done by research and meetings with the experts from CINAT, allowing a wider area comprehension where is being worked, transferring all this knowledge and form of identification to the objective application.

The intention is to program a taxonomic database with the necessary inputs, that will be used by the application and the implementation of an identification algorithm, to determine to which specie does the bee belong to or inside which range can the it be found. Only Meliponini tribe species inside costa rican territory are contemplated.

On the other hand, the evaluation of the application will be done be experts from CINAT (Tropical Apiculture Research Center) and for the specie previously selected.

It is worth mentioning that the OpenCV SDK will be used as a core for the imaging processing which has different open source libraries that allow to perform different steps for image characterization, as they are, image load, gray assignation, modification of pixels, segmentation, obtaining the contour, area and perimeter besides the manipulation, processing and saving the image.

As it has mentioned, the application will run only on mobile devices, compatibles with Android operating systems, this way to avoid monetary expenses to acquire development licenses needed for the development in other environments.

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