POLITECNICO DI TORINO
Dipartimento di Automatica e Informatica

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Deep Supervised Embedding for Fish Species Identification

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Introduction

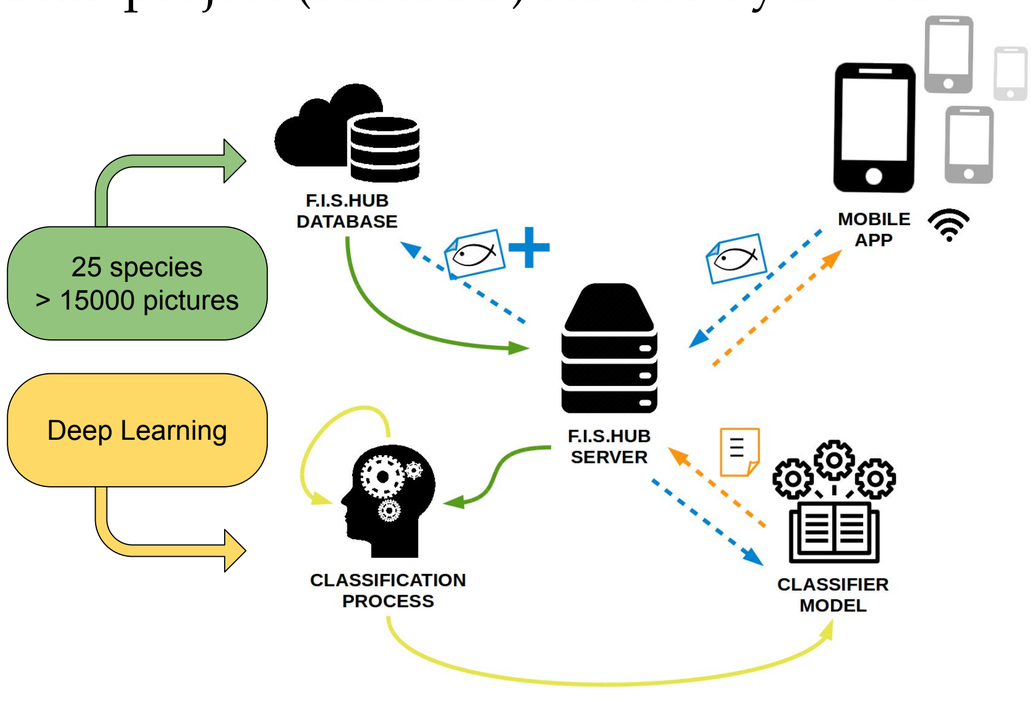
Fish and seafood are among the top ten commodities considered by EU as the most at risk for frauds. Mislabelling, and in particular **species substitution**, i.e. selling a species different from that declared on the label, is the most frequent frauds in seafood (*Report on the food crisis, fraud in the food chain and the control thereof (2013/2091(INI))*).Currently the two most used countermeasures are visual inspection and DNA analysis. *Rossi et al.* proposed a proof-of-concept method based on a morphological features identification via computer vision techniques[1].

Objectives

The main objective is to overcome the limitations of those methods by creating an objective fraud detection software usable on the field by trained personnel as well as un-experienced end users.

The software will be able to identify the species of a fish from its digitized picture. It will be composed of a **photo database** and a **machine learning server** for image analysis and **classification**. Eventually it will be accessible through a user-friendly **mobile app** for phones and other portable devices.

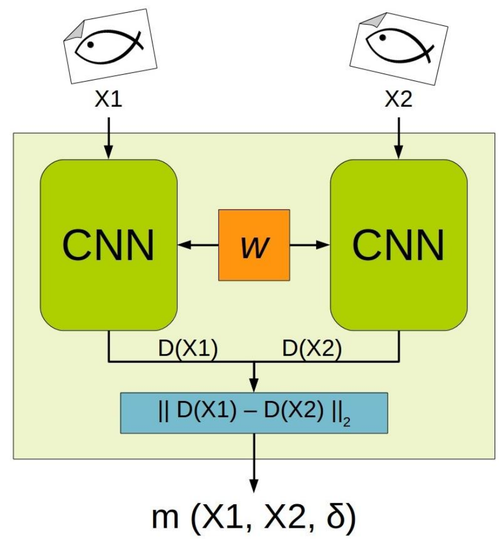
This research is the outcome of the partnership in the Fish Identification Software Hub project (**FISHUB**) funded by EU-FP7.



Method

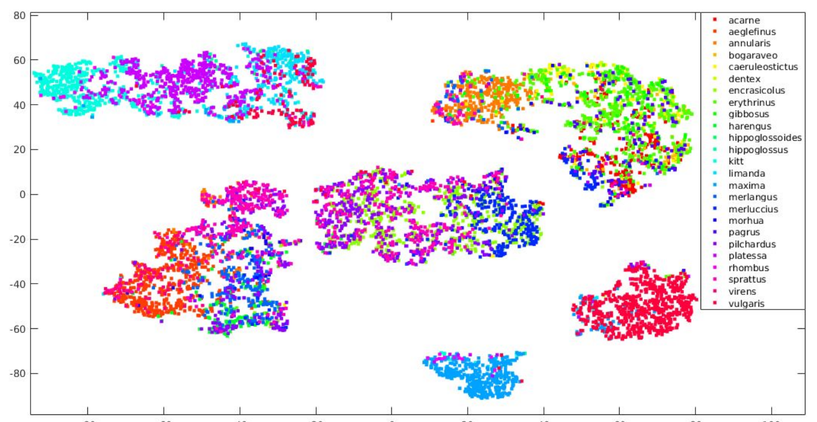
A list of fish species was selected to create the image database (DB) according to commercial importance and likelihood of substitution (more than **15000 images** related to **25 species**). The images were used to train an **embedding classifier** based on two Convolutional Neural Network (CNN) called **Siamese Network**.

Instead of a model learning to classify its inputs, this networks learns to differentiate between the inputs. In fact, this approach allows to measure the (dis)similarity among the species.



Hence the classifier generates a metric that allows to cope with confidence and mistrust interval and it can also clusterize unknown species with respect to those present.

Results



Testing was done on a test set of size 1500 and the **overall accuracy is ~90%** (performed evaluating, for each image, the average distance between a subset of 20 random images per species). The software of the FISHUB mobile application will be based on this deep supervised embedding classifier.

Reference

[1] Rossi F. et al.; FishAPP: A mobile App to detect fish falsification through image processing and machine learning techniques. In: 20th IEEE International Conference on Automation, Quality and Testing, Robotics, AQTR 2016, Cluj-Napoca, RO, 19-21 May 2016. pp. 1-6