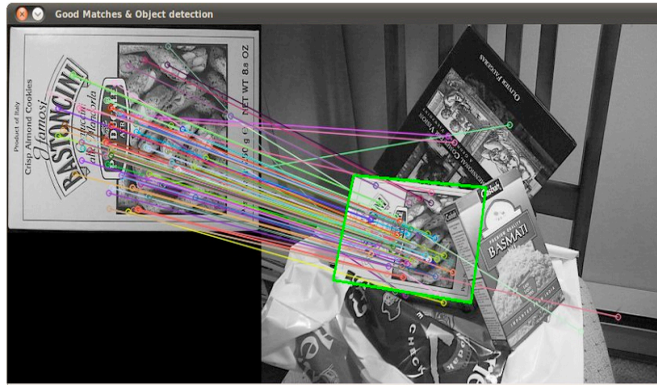Project 1: Detecting objects in digital images using OpenCV library and describing its qualitative topology and orientation

General Description

The Open Computer Vision library (OpenCV) provides a powerful interface for image processing. One of the most interesting options in OpenCV is their feature descriptors and detectors which can be used for identifying objects in digital images.

Obtaining narratives that cognitively describe digital

images is still a challenge in AI. In this project, a step forward meeting this challenge is proposed by using the OpenCV for detecting objects and defining an approach for qualitatively describing the spatial properties of those objects in the images. The qualitative properties extracted can be easily used in narratives for human computer interaction.

Keywords: OpenCV, C++, Features descriptor and detector, Topology, Qualitative Orientation, Qualitative Distance.

Orientative Tasks

1. Install OpenCV on your Mac or Linux System [1].
2. Understand how SURF feature detector works [2-3].
3. Test SURF using the OpenCV tutorial *2dfeatures module*. 2D features framework:
    3.1. Download the C++ code, compile and test the matcher Fast Approximate Nearest Neighbour [4].
    3.2. Download the C++ code, compile and test the object detector *Features2D + Homografy to find a known object* [5].
4. Improve the tutorial C++ code so that you can detect at least 3 objects in a digital image, i.e. the three books in the given image.
5. Understand how to extract and describe qualitative spatial information from digital images [6].
6. Define your own approach for describing the spatial relations of topology and orientation of the objects in a digital image. For example, the relative distance relations (i.e. close, near, far, etc.) between the boxes in the given image, their orientation with respect to each other (i.e. right, left, front, back, etc.) and their topological situation (i.e. touching, disjoint, etc).
7. Test your approach on some digital images taken in the common areas of the CoSy department.
8. Identifying the most important objects in the images taken at CoSy department and describing their spatial relations.

References

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[3] SURF web page: http://www.vision.ee.ethz.ch/~surf/index.html

[4] Matching with FLANN using OpenCV *2dfeatures module*. 2D features framework: http://docs.opencv.org/doc/tutorials/features2d/feature_flann_matcher/feature_flann_matcher.html#feature-flann-matcher

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[6] Falomir Z., Museros L., Gonzalez-Abril L., Escrig M. T., Ortega J. A. (2012). A Model for Qualitative Description of Images based on Visual and Spatial Features, *Computer Vision and Image Understanding*, 116: 698-714. DOI: 10.1016/j.cviu.2012.01.007.