ASIFT
Method and device for the invariant-affine recognition of shapes

Context:

The problem of image comparison (invariant to viewpoint change), i.e., recognition of objects in digital images taken from arbitrary camera positions, is difficult. The problem has been only partially resolved in the recent years (between 1999 and 2004) by two algorithms, SIFT and MSER and their variants. The limitation of SIFT is that it fails to work when the viewpoint angle difference exceeds 45 degrees. MSER requires that the shapes presented in the images are well contrasted over a background, and it fails to work if there is a large zoom (larger than x3). There are some variants of SIFT that seek invariance to affine transform through a normalization procedure, but these methods are inexact and the state-of-the-art seems not improve much with respect to SIFT.
The fundamental problem resolved by this method is the exhaustive comparison between images with a minimum constraint on viewpoint angles.
A big advantage is the large diffusion of the competitor algorithms, in particular SIFT (patented), with respect to which the improvement is clear.

Technical description:

ASIFT is an algorithm that allows to recognize in a digital image an object for which one has views under different viewpoint angles and/or taken by other systems from other viewpoints.
As most state-of-the-art methods, the algorithm recognizes planar and local features of the object. These local features are deformed in a space of 7 parameters, corresponding to position in space (3 parameters), orientation in space (3 parameters) and focal distance (1 parameter) of the camera that is used.
Nevertheless, for the recognition of local features of images this space can be reduced to 6 parameters of an affine transformation taking into account 3 parameters for rotation, one for zoom, and two for translation. The current state-of-the-art allows treating perfectly the parameters of zoom, translation, and one parameter of rotation out of three, the other two being only imperfectly processed, which prevents from reliable recognition when the angle difference between the optical axes of the two cameras exceeds 45 degrees.
The proposed procedure allows treating completely the two other parameters of rotation and therefore to treat all the relative positions of the two cameras, until an angle of 80 degrees, which is close to the absolute limit (90 degrees).

Assets:
- Simplicity,
- Quickness,
- Mathematical and practical proof of optimality.

Maturity level:

The algorithm is ready and demonstrable.
An online demo: http://demo.ipol.im/demo/my_affine_sift/

Potential markets:

Analysis of large image databases, 3D reconstruction from multiple viewpoints, organization of multiple views of a same object, camera calibration, general public applications in photo collection management and image search, navigation by vision (robotics, automatic vehicles), tele surveillance, video surveillance, satellite imaging, camera-aided production control, analysis of basket of super-markets (recognition of products) control, and in general all industrial procedure using cameras for object or environment recognition or for shape reconstruction.