Aerial stereo photography has been widely used by geologists for many years. Close range stereo photography has been also used extensively. Both technologies are still commonly used, thanks to their simplicity and low cost. Both techniques rely in stereo vision, although the belong to a more wide branch of science, photogrammetry.

Photogrammetry is the science of making measurements from photographs, especially for recovering the exact positions of surface points. Photogrammetry is as old as modern photography, can be dated to the mid-nineteenth century.

IdeasCAD interests in stereoscopic technologies drive us to collaborate with the University of Oviedo Fold Analysis Group. As a result of these collaboration we developed several computer programs based on stereoscopic pairs.

http://www.geol.uniovi.es/investigacion/grupos/ofag
The first tool is called VISAGE, an application to see a stereo pair and manually recover a 3D model. It was originally oriented to geologic works, but it can be used in other applications, like building restitution, medical image, reverse engineering, etc.

VISAGE has been written in .Net C# using the GLSV engine. The user can see pairs of stereo photos, with total control of all the variables involved. Vectorial entities can be drawn using the mouse as a 3D pointer. The reference system can be defined by the user using the terrain coordinates module. The DXF format is used to export and import that vectorial entities to or from a CAD program. VISAGE is able to split between different stereoscopic modes: anaglyph, alternated pages and quadro.
The second tool is called STEREO RECTIFICATION. It solves the problems of camera calibration, both intrinsic and extrinsic, using markers of known coordinates or just correspondence points. Its output can be a point cloud, recovered from the stereo pair; or a new pair of photos, after rectification and undistortion. The new pair could be used, for example, in VISAGE to manually recover a 3D model.

STEREO RECTIFICATION uses OpenCV library through Emgu wrapper. We have implemented different mathematical methods to solve the problems of intrinsic and extrinsic calibration of the stereo pairs, with automatic detection of features.
At present we have moved to other photogrammetry methods not limited to stereo setups. Structure From Motion algorithms estimate three-dimensional structures from two-dimensional image sequences. The result is a point cloud calculated from sets of three or more corresponding pixels, each one of a different frame. As point clouds are not easy to interpret on a computer screen, we have developed a new tool called CLOUD. The scientist visualize the point cloud on a virtual reality environment. CLOUD provides tools to move, rotate and scale the point cloud, and also to draw, erase, modify and export 3D polylines using a virtual 3D mouse.

We have developed other applications around photogrammetry. For example, Texture Recover is used to re-draw an orthogonal projection of a "texture seen foreshortened in a photography".

Although not really included in this branch of research, but close to it, Ideas CAD has worked in Geographic Information Systems, GIS. We have developed a GIS viewer called AEGIS, based on ArcGIS technology.

Papers

Construction of accurate geological cross-sections along trenches, cliffs and mountain slopes using photogrammetry
Santiago Martín, Hodei Uzkeda, Josep Poblet, Mayte Bulnes, Ramón Rubio
Computers & Geosciences, Volume 51, February 2013, Pages 90-100
ISSN 0098-3004, http://dx.doi.org/10.1016/j.cageo.2012.09.014

Geological cross-section and structural analysis of metre-scale fault-related folds in the Cantabrian Zone, NW Iberian Peninsula
Isabel Moriano, Mayte Bulnes, Josep Poblet, Santiago Martín
Geo-Temps 07/2012; 13:537-540 (VIII Congreso Geológico de España)