UNIVERSIDADE DA CORUÑA

RNASA - Lab
Laboratorio de Redes de Neuronas
Artificiales y Sistemas Adaptativos

CITEEC
Centro de Innovación Tecnolóxica
en Edificación e Enxeñaría Civil

VADEMA. Study of Strength Tests with Computer Vision Techniques

Introduction

In strength tests, loads or strains are applied to a material. The information about the material's behaviour is traditionally obtained using devices which can only provide readings in one dimension which interfere with the experiment generating certain stiffness to displacement.

To overcome this limitations, a new way of analyze strength tests is proposed, using a video camera to record the test and then processing the images to extract the full displacement field of the body.

Algorithm purposed

The proposed algorithm uses the philosophy of the standard Block-Matching procedure. Analysing the statistical similarity of the grey levels in each region (bock) of the image. The purpose is to solve the correspondence problem for each region, finding in the next image the region representing the most likely displacement.

In order to obtain accurate measurements in a real scale, the pin-hole projective model was used together with a numerical model of distortions.

To calculate the parameters of the model, a standard calibration pattern is used.

Source Images · Image Correction · Discrete Analysis · Calibration Data · Motion Vectors · Sub Pixel Analysis

Results

Two sets of experiments were carried out.

The obtained were compared with those obtained by the following Block-Matching based techniques:

- The Block-Matching from the OpenCv library.
- The DaVis system, from LA Vision. A commercial System based on the PIV technology.

Synthetic images

In this experiment, two test sequences for benchmarking optical flow algorithms were used. A synthetic sequence from the data-bank of the Otago University (New Zealand) and the Yosemite synthetic sequence.

Strength test

The behaviour of a steel bar used in the construction industry as reinforcement of structural concrete was analysed. The material was subject to traction forces until break-up point. This assay was performed at the Centre of Technological Innovation in Construction and Civil Engineering (CITEEC).
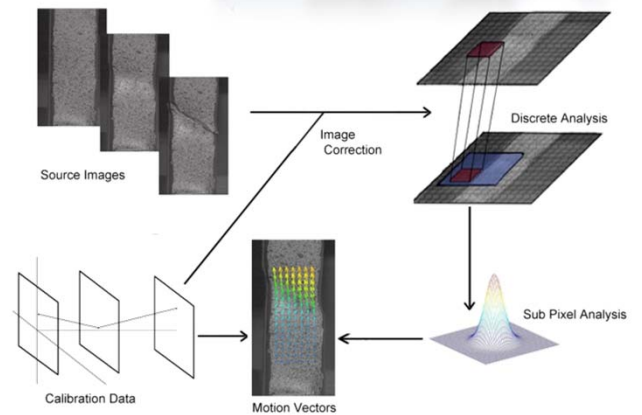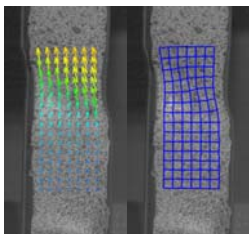
Algorithm	Cube		Yosemite	
	Avg Error	SSD Error	Avg Error	SSD Error
This Work	0.28	0.38	0.14	0.15
DaVis	0.54	0.79	0.16	0.18
Block-Matching	2.14	1.00	0.45	0.45

This Work · DaVis (Raffel et al. 2007) · Block Matching (OPENCV 2010)
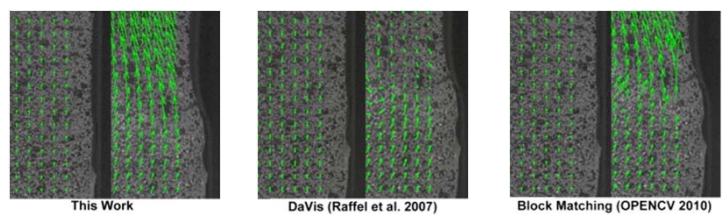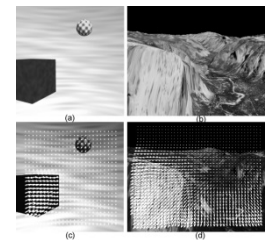
Conclusions

- Strength tests can be analyzed using Block-Matching techniques achieving more flexible measurements than traditional instrumentation.
- A new technique to analyze the tests using Block-Matching principles is introduced.
- The proposed technique retrieves the complete displacement field of the surface providing information about the global behaviour of the material being tested.
- The proposed technique has obtained the best results in the assays with synthetic images and with the images from a real strength test.

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