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# IS 3D–SHAPE ESTIMATION NECCESSARY IN MODEL BASED IMAGE CODING?

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**Abstract**

For object–oriented analysis–synthesis coding [1] an image analysis algorithm is required which automatically generates the parameter sets which allow to synthesize an image sequence. Several groups are involved in image analysis assuming 3D–models [2, 3, 4]. In this contribution the importance of reliable shape estimation is pointed out.

When doing image analysis of video sequences based on the model of 3D objects, goal of the modelling is to generate a model scene which is close to the analysed real scene. In coding of moving images objects have to be segmented, their motion and their shape has to be estimated. Motion and shape estimation depend on each other. This is shown by the following experiment with artificial images.

There is a 3D model world with the model object CLAIRE and a fixed model camera, with which we can take pictures from the model world, is used for computing model images. For the 3D model object CLAIRE a **start position** is defined. The corresponding model image is named **start image**. For CLAIRE a motion vector $\mathbf{m} = (t_x, t_y, t_z, r_x, r_y, r_z) = (5, 5, 5, 5, 5, 5)$ is defined. CLAIRE is moved by **m** and then a model image is generated by means of the fixed model camera. This model image is named **reference image**.

In the first experiment CLAIRE is placed at its start position. Now a motion estimation algorithm estimates the motion between the start image, represented by CLAIRE at its start position, and the reference image. In this setup any proper 3D motion estimation algorithm will estimate the correct motion.

There is one major difference between this experiment and real image analysis. In real scene the shape of the objects is unknown.

Therefore in the second experiment we use the same model and reference image as before but the shape of CLAIRE is modified:
CLAIRE is placed at start position. Each visible surface point of CLAIRE is moved on its line of sight. Line of sight is a ray starting on the surface of CLAIRE in the direction of the point of focus of the model camera. By moving points of CLAIRE's surface on these lines of sight the start image taken from CLAIRE at its start position is not changed. Picture 1 shows side views of CLAIRE's shape.
Now the same motion estimation algorithm as before estimates the motion between the start image, represented by modified CLAIRE at its start position, and the reference image. In this setup any 3D motion estimation algorithm will estimate wrong motion parameters. Table 1 shows the result. In this example motion estimation compensates wrong object shape by large translation on the camera axsis and wrong rotation around the y–axsis.

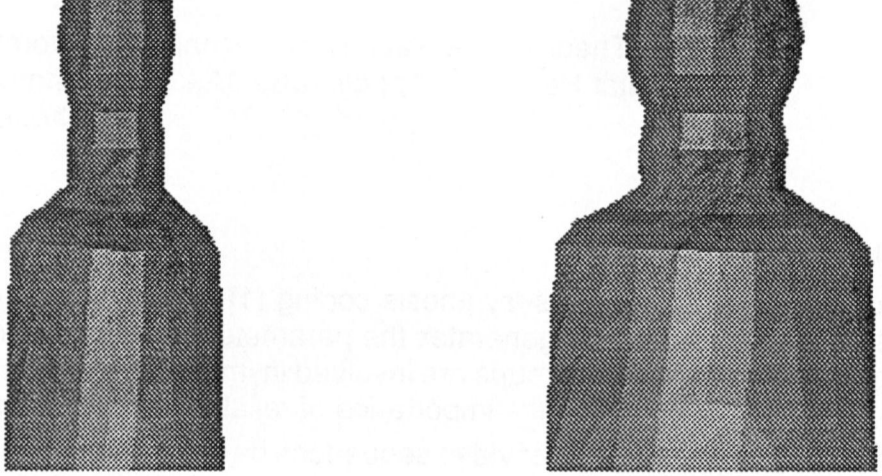

Bild 1: Side view of CLAIRE's shape, left) original CLAIRE of the first experiment, right) modified CLAIRE of the second experiment

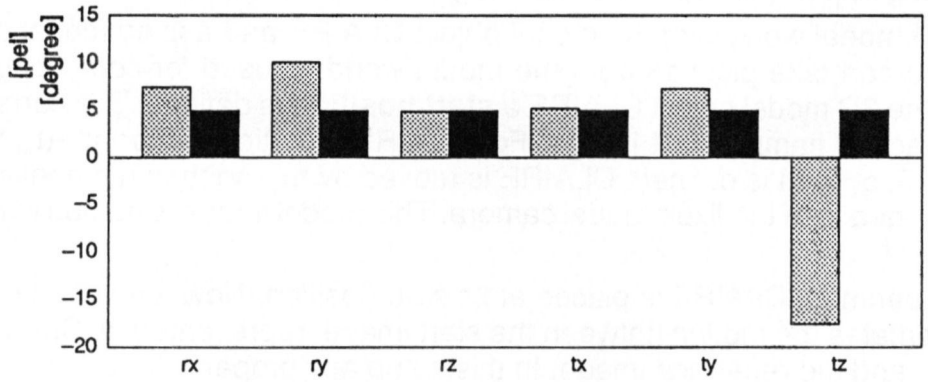


Table 1: Comparison of estimated (grey) and correct (black) motion parameters

These two experimants show that there is a strong demand for shape estimation as soon as 3D models are used in object based image coding.

**References**:

[1] Jörn Ostermann, "Color parameter coding for arbitrarily shaped image regions", COST 211–ter, SIM 91/7.

[2] Bilkent University, "Facial feature analysis and synthesis using muscle contractions", COST 211–ter, SIM 91/46.

[3] Matthias Buck, "Construction of a 3D face model and its adaptation to a video scen", COST 211–ter, SIM 91/61.