Progressive low bit rate coding of simple 3D objects with Matching Pursuit

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This paper presents a low rate progressive 3D mesh compression scheme for simple, genus-zero 3D objects. The proposed scheme is based on signal representation using redundant expansions on the 2D-sphere. First, generic input data is re-sampled as a function on the 2-sphere, and the signal value for each point on the regular grid is obtained by performing nearest neighbor interpolation within four points from the initial 3D model. The model representation is then constructed using a Matching Pursuit algorithm, with an overcomplete dictionary of atoms, defined on a sphere. This set of atoms is derived from generating functions that are appropriately translated, rotated and anisotropically scaled to span the entire space of the input signal. In order to efficiently capture the particular characteristics of 3D models we propose a dictionary construction based on two generating functions: a Gaussian to capture low-frequency, and a modified combination of a Gaussian and its second derivative to capture high-frequency components of the input signal.

Our method has been compared to state-of-the-art encoders where it has been shown to offer very good compression efficiency (see Figure 1), but the performance is limited by the resampling step, that maps the input model on the 2d-sphere. Matching Pursuit has however the advantage of providing an intrinsically progressive scheme, that is additionally very flexible. Such advantages become very important in view-dependent streaming of model information, or in scalable applications.

For more details on the coder, please visit http://lts4www.epfl.ch.

(a) MP with 600 coefficients (2.5161KB, 60.8840dB).

(b) Original model.

Fig. 1. Matching Pursuit representation of Venus.

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