3D WATERMARKING: Data Hiding on 3-D Triangle Meshes

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Problem Definition

- Hiding information into 3D Objects with minimum distortion rate,
- And make the watermark robust against attacks.
The Method is Robust against:
Translation, Rotation and Scaling.

TSPS: Triangle Strip Peeling Sequence.
[Cayre et al April 2003]
Considers triangles as two state objects.
3D Objects -> 2D Traingles.
Uses a "Secret Key".
Intro

- Blind Watermarking

Method is Implemented as Blind Watermarking
Proposed Method

The basic idea behind TPSS:
keep moving along triangles and
add data to this triangles
Quantization - 1

Base Quantization When $n = 1$
Quantization - 2

Base Quantization When \( n = 2 \)
Hiding Data

- Start Triangle to be determined: Choose the smallest triangle.
- Then data is hidden according to the “Key”.
Algorithm - 1

1. Load Object
2. Watermark?
   - No
   - Yes
     - Create Key
     - Find Smallest Triangle
     - Reorder Triangles
3. Form TSPS

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Algorithm - 2

Is Triangle Quantizable?

Yes

Quantize Current Triangle

No

Key List Empty?

No

By Pass It and Register.

Yes

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Algorithm - 3

- Get Data Using Key and Display Object
- Add Noise?
  - Yes: Calculate Error, and Parameters.
  - No: Add Random Noise

Completed!
Some Parameters

- Fill Rate
  \[ R_{fill} = \frac{N_{\text{bits}}}{N_{\text{verts}}} \]

- Distortion Rate
  \[ R_{\text{dist}} = \frac{\lambda_{\text{max}}}{L_{\text{max}}} \]

- Coding Speed
  \[ R_{\text{cod}} = \frac{N_{\text{Stencil}}}{N_{\text{bits}}} \]
Our demo is a simple app. Showing practical usage of this method.

- Uses 3D Models.
- Adds random noise.

Source Code:

http://ieee.metu.edu/~teke/3DWat
While the demo working