Point Cloud Quality Assessment

Multimedia Signal Processing

Introduction

What is a Point Cloud?
- 3D representation of the real visual world by a set of 3D coordinates (points) with some attributes such as color
- Applications:

Why Quality Assessment?
- Point clouds need to be acquired and coded to be stored and transmitted
- Acquisition and coding may lead to distortions of several types
- Reliable metrics are necessary to measure the degradation both in terms of geometry and color

Objectives
- Subjective Study of different type of distortions, considering acquisition, compression and rendering
- Propose new metrics to assess the quality of a point cloud automatically:
  - Geometry quality
  - Color quality
  - Overall quality

Performed Subjective Studies

Point Cloud Artifacts

State of the Art Objective Quality Metrics
- Point to Point: measures the distance between each point of a degraded point cloud to the nearest neighbor point in the reference point cloud
- Point to Plane: measures the distance between each point of a degraded point cloud to the underlying plane on nearest neighbor point in the reference point cloud
- Plane to Plane: based on the angular distance between tangent planes that correspond to associated points

Subjective and Objective Study of Denoising Algorithms
- Subjective assessment methodology for point cloud denoising algorithms
- Study on the correlation of available objective quality metrics with user subjective assessment

Subjective and Objective Study of Compressed Point Clouds
- Study the correlation of available objective quality metrics with user subjective assessment
- Double-Stimulus Impairment Scale method has been used for subjective assessment

Impact of 2D Rendering on Subjective Quality Assessment of Point Clouds
- Study the impact of point cloud rendering in terms of quality of experience and objective quality assessment
- Loot coded with TMC1 low rate with 5 different renderings

Achievements

Publications
1) A. Javaheri, C. Brites, F. Pereira, J. Ascenso, Subjective and Objective Quality Evaluation of Compressed Point Clouds, IEEE Workshop on MultiMedia Signal Processing - MMSP, Bedfordshire, United Kingdom, Vol., pp. -, October, 2017 (Top 10% Award)