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**V-PCC Exploration Experiment 2.4 on Homography Representation of per Patch Transform**

# Abstract

This document provides a description of Exploration Experiment 2.4 on Homography Representation of per Patch Transform.

# Introduction

The goal of Exploration Experiment 2.4 is to evaluate a new proposal for patch encoding based on homography transforms.

The performance of the techniques [1] is evaluated in the scope of the EE 2.4, in terms of RD performance and computational complexity.

# Mandates

The mandates for CE are as follows:

1. Evaluate the impact of Homography Coding in terms of performance and complexity
2. Identify possible drawbacks and limitations of the proposed method
3. Identify possible advantages on having a more flexible patch generation scheme
4. Identify possible alternative signaling schemes
5. Evaluate other contents (e.g. MIV content)

# Participants

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(P=proponent, C=crosss checker)

# Methods to be evaluated

## m47499 “Homography Patch Coding”

In the current PCC model, the patch generation process can be interpreted as a projection of a subset of points to a virtual orthographic camera. If the point cloud is provided in world coordinate system, to generate the projections, three steps are necessary: (1) projection from world to camera coordinate system, (2) projection from 3D camera coordinate system to 2D projection plane, and (3) 2D projection from the camera projection plane to the pixel plane. The three operations can be modeled by the following homography transforms:

1. Model View Transform

where the rotation matrix depends on the camera orientation, and currently assumes only values between 1 and -1;

1. Projection Transform

where the translation vector is given by the 3D bounding box corner, and the sign for the z coordinate is determined by the projection mode

1. Viewport Transform

where the 2D rotation and the translation are given by the patch orientation and location in the 2D canvas.

Notice that the choices of coefficients above are restricted due to the modeling of the patch generation cameras, but the proposed notation can allow for a much more flexible model.

To generate the homography transform, we just need to multiply the above matrices, ending up with a 4x4 matrix, as shown in the picture below. To reconstruct the 3D points, one just needs to invert the homography transform and reproject the points into 3D space. Notice that we could also use the homography transform directly into the Graphics Pipeline, by simply adding the homography matrix multiplication in the pipeline.

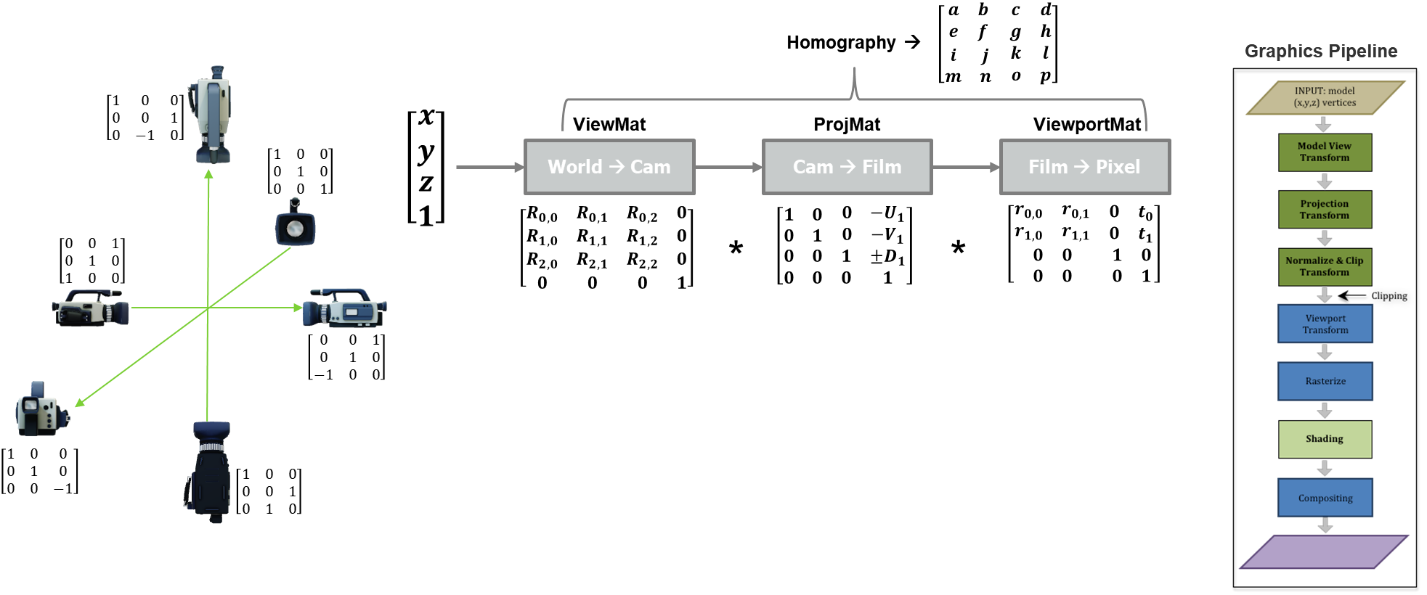


Figure 1: Homography matrix generation process for PCC, following the graphics pipeline.

# Evaluation method

## Test condition

Proposals will be implemented on top of TMC2v7.0. Test conditions will follow the CTC conditions.

# Timeline

* 2019-07-12 MPEG #127 meeting ends.
* 2019-07-26 V-PCC: Expected date for release of finalized CE description and CTC.
* 2019-08-02 V-PCCv7.0 software.
* 2019-08-02 Expected date for release of cross-verified V-PCCv7.0 software and anchors
* 2019-09-18 V-PCC CE Software and results are released to cross-checkers
* 2019-09-25 V-PCC preliminary feedback from cross-checkers
* 2019-10-02 MPEG document upload deadline
* 2019-10-07 MPEG #127 meeting starts.

# References

1. “[V-PCC] New Contribution on Patch Coding,” ISO/IEC JTC1/SC29 WG11 (MPEG) input document m47505, Geneva, CH, March 2019