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**INTERNATIONAL ORGANISATION FOR STANDARDISATION
ORGANISATION INTERNATIONALE DE NORMALISATION
ISO/IEC JTC1/SC29/WG1 & WG11**

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Abstract

In response to the call for Visual Test Material for immersive applications [N17462, N17471] video content acquired with a R8 Raytrix camera and converted into 5x5 Multiview format is proposed. Each view is provided with a disparity map.

1 Introduction

In response to the call for Visual Test Material for immersive applications [N17462, N17471] video content acquired with a R8 Raytrix camera [1] and converted into 5x5 Multiview format is proposed with a disparity map associated to each view. Three different scenes have been captured by the camera. The video content, capturing conditions and how the views were extracted are detailed below. Then available data for download are listed.

2 Description of the video content

Three different scenes have been captured with a [R8 Raytrix](#) video camera equipped with a 35mm lens. These videos are:

- ChessPieces,
- Boxer-IrishMan-Gladiator,
- ChessPieces-MovingCamera.

These videos were recorded at 30 fps with the Raytrix software RxLive 3.1 [2]. Each frame has a 1920x1080 resolution. The first frame of each video is displayed in Figure 1 :



Figure 1: First frame of the three videos “ChessPieces”, “Boxer-IrishMan-Gladiator” and “ChessPieces-MovingCamera”

The Raytrix R8 camera equipped with a 35mm lens can precisely capture a scene included in a 10cm x 10cm x 10cm volume. The proposed captured scenes are included in such a volume.

2.1 Chess Pieces

The video sequence "ChessPieces" contains four chess pieces, two knights and two pawns turning on a turn table and with a calendar as background. The R8 Raytrix camera was located at 35cm from the scene. It is composed of 300 frames.

2.2 Boxer-IrishMap-Gladiator

The video sequence "Boxer-IrishMan-Gladiator" contains three Lego characters turning on a turn table and with a calendar as background. It is composed of 300 frames.

2.3 ChessPieces-MovingCamera

In the video “ChessPieces-MovingCamera” the scene, composed of chess pieces, is static but the camera is moving. The latter is located at 60 cm from the scene. The video contains 300 frames.

3 Extraction of views

The Raytrix software RxLive [2] stores data received from the R8 camera as a Raytrix sequence file. We used the Raytrix API [3] to access each Raytrix frame in the Raytrix sequence file in order to extract twenty-five views as if we had twenty-five virtual cameras (5 rows x 5 columns). Each camera is supposed to be 4 mm away from its neighbour.

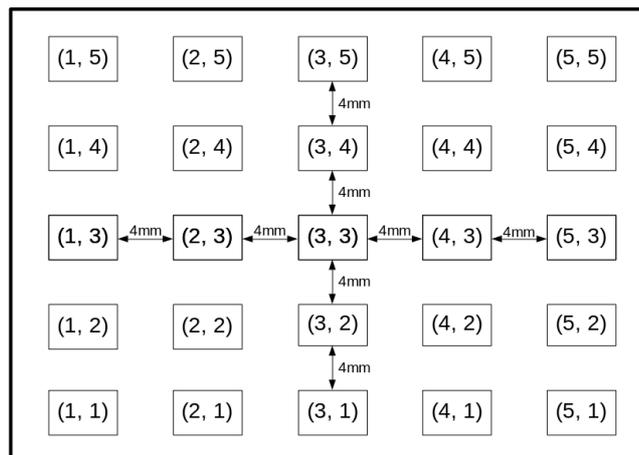


Figure 2: 25 virtual cameras per frame one for each extracted view

To do so, we take advantage of the function [Rx::ApiLF::RxSetPar](#). Called with the parameter "Rx::ApiLF::EPar::VirtCamPinholeStd_ViewOffsetMM_g", it allows to specify an offset of a virtual camera in the plane perpendicular to the z-axis of main lens. The offset has a horizontal value of 4 mm and a vertical value of 4 mm and is measured from the center of main lens. The

extracted views are numbered in the downloadable zip files (cf. Data available for download) as depicted in Figure 2 (e.g.: sa_1_3.png for the coordinates (1, 3)).

4 Disparity maps

For each view of each frame, a disparity map was computed. As we have extracted 25 views per frame, 25 disparity maps were computed per frame: one disparity map for each extracted view. To do so, we used a simplified version of works presented in [4] and apply it to the extracted views. Below are, for instance, the disparity maps of the central view (i.e. coordinates (3,3)) that we obtained for the first frame of each video:



Figure 3: Disparity map of the central view of the first frame for “ChessPieces”, “Boxer-IrishMan-Gladiator” and “ChessPieces-MovingCamera”

For each video, a minimal and maximal disparity (in pixels) between two adjacent views is given in the following table:

Video name	Minimal disparity (pixels)	Maximum disparity (pixels)
Chess-Pieces	-1.52	0.45
Boxer-IrishMan-Gladiator	-1.50	0.39
ChessPieces-MovingCamera	-1.67	0.11

Table 1 : minimal and maximal values for disparity maps

These values can be used to get the disparity values from the disparity map provided as PNG. A linear conversion can be applied where 0 is the minimal disparity and 255 the maximum disparity.

5 Data available for download

Several kinds of data can be downloaded from the web site describing and hosting the data [5] for each frame:

- a raw picture, i.e. the raw picture captured by the sensor of the Raytrix camera,
- 5x5, i.e. 25, extracted views
- 5x5, i.e. 25, disparity maps, each of them being associated to a specific extracted view.

All this data is provided for the 300 frames of the videos, but the number of the first frame is different according to the video:

- ChessPieces : 1,
- Boxer-IrishMan-Gladiator: 400,
- ChessPieces-MovingCamera: 210.

Moreover, for each video an XML file containing the calibration parameters of the Raytrix camera during the capture is provided (cf. 8.2).

6 Acknowledgement

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7 References

[N17462] Bart Kroon, Gun Bang, Pavel Nikitin, Mehrdad Panahpour Tehrani, Gauthier Lafruit, “Call for MPEG-I Visual Test Materials on 6DoF,” ISO/IEC JTC1/SC29/WG11 MPEG2018/N17462, January 2018, Gwangju, Korea.

[N17471] Renaud Doré, Bart Kroon, Miska Hannuksela, Mary-Luc Champel, Jill Boyce, “Call for Test Materials for 3DoF+ Visual,” ISO/IEC JTC1/SC29/WG11 MPEG2018/N17471, January 2018, Gwangju, Korea.

[1] <https://raytrix.de/products/>

[2] <https://raytrix.de/downloads/#tab-id-3>

[3] <https://www.raytrix.de/Rx.ApiLF.3.1/index.html>

[4] X. Jiang, M. Le Pendu, C. Guillemot, Depth estimation with occlusion handling from a sparse set of light field views, submitted to IEEE International Conf. on Image Processing, 2018.

[5] <https://www.irisa.fr/temics/demos/lightField/CLIM/DataSoftware.html>

8 Annex

8.1 Sensor and MLA description

The Raytrix API (cf. https://www.raytrix.de/Rx.ApiLF.3.1/namespace_e_par.html) provides information about the sensor of the R8 camera and its Micro Lens Array (MLA). The following table gathers them:

Sensor_PhysicalPixelSizeMM (widthxheight)	21.12x11.88 mm
Sensor_PhysicalPixelSizeMM	0.0055 mm
Ray_width	3840 pixels (i.e. 21.12/0.0055)
Ray_height	2160 pixels (i.e. 11.88/0.0055)
Mla_LensPitchPX	34.9767 pixels
Mla_LensPitchMM	0.192372 mm
Mla_LensTypeCount	3
Lens #0 MlaSensorDistanceMM	0.222 mm
Lens #0 MlaFocusRangeMinVD	1
Lens #0 MlaFocusRangeMaxVD	3.2
Lens #1 MlaSensorDistanceMM	0.222 mm
Lens #1 MlaFocusRangeMinVD	2.6
Lens #1 MlaFocusRangeMaxVD	4.2
Lens #2 MlaSensorDistanceMM	0.222 mm
Lens #2 MlaFocusRangeMinVD	3.5

Lens #2 MlaFocusRangeMaxVD	100
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Table 2: Sensor and MLA characteristics of the Raytrix R8

8.2 Calibration parameters

The calibration parameters used for the dataset can be downloaded from the web site [5] for each video as an XML file. Here is an example (associated to “ChessPieces”):

```
<RayCalibData version="1.0">
  <offset units="pix">
    <x>13.251828948215</x>
    <y>-7.587459995462</y>
  </offset>
  <diameter units="pix">34.976657867432</diameter>
  <rotation units="rad">0.000000000000</rotation>
  <lens_border units="pix">0.999999915334</lens_border>
  <tcp units="virtual_depth">2.133058547974</tcp>
  <lens_base_x units="lens">
    <x>1.000000000000</x>
    <y>0.000000000000</y>
  </lens_base_x>
  <lens_base_y units="lens">
    <x>0.500000000000</x>
    <y>-0.866025388241</y>
  </lens_base_y>
  <sub_grid_base units="lens">
    <x>3.000000238419</x>
    <y>-1.732050776482</y>
  </sub_grid_base>
  <distortion type="radial">
    <function>constant</function>
    <parameter count="0">0</parameter>
    <offset units="pix">
      <x>0.000000000000</x>
      <y>0.000000000000</y>
    </offset>
  </distortion>
  <lens_type id="0">
    <offset units="lens">
      <x>0.000000000000</x>
      <y>0.000000000000</y>
    </offset>
    <depth_range units="virtual_depth">
      <min>1.000000000000</min>
      <max>3.200000047684</max>
    </depth_range>
  </lens_type>
  <lens_type id="1">
    <offset units="lens">
      <x>1.000000000000</x>
      <y>0.000000000000</y>
    </offset>
  </lens_type>
</RayCalibData>
```

```
<depth_range units="virtual_depth">
  <min>2.599999904633</min>
  <max>4.19999809265</max>
</depth_range>
</lens_type>
<lens_type id="2">
  <offset units="lens">
    <x>-1.000000000000</x>
    <y>0.000000000000</y>
  </offset>
  <depth_range units="virtual_depth">
    <min>3.500000000000</min>
    <max>100.000000000000</max>
  </depth_range>
</lens_type>
</RayCalibData>
```