INTERNATIONAL ORGANISATION FOR STANDARDISATION
ORGANISATION INTERNATIONALE DE NORMALISATION
ISO/IEC JTC1/SC29/WG11
CODING OF MOVING PICTURES AND AUDIO

ISO/IEC JTC1/SC29/WG11 MPEG2014/M32249
January 2014, San Jose, USA

Source **Poznań University of Technology,**
Chair of Multimedia Telecommunications and Microelectronics
Status **Contribution**
Title **Z-distance-based search range in Depth Estimation Reference Software**
Author Krzysztof Wegner (kwegner@multimedia.edu.pl)
Olgierd Stankiewicz

1 Introduction

This document proposes a new way of defining search range for depth estimation reference software. Proposed z-distance-base method is more user friendly in case of arbitrary camera arrangements.

2 Disparity Search Range

Currently in Depth Estimation Reference Software 6.0 (DERS 6.0) [1], correspondence search range is configured by the following two parameters:

- MinimumValueOfDisparitySearchRange,
- MaximumValueOfDisparitySearchRange.

Both of these specify range of disparity values for which image correspondence is sought. If linear camera arrangement (with parallel axes of the cameras) is used, such approach is convenient, as it clearly specifies pixels positions, relatively to the center view, which are considered in the left and right views (Fig. 1). If another arbitrary camera setup (non-linear) is used, the correspondence search is performed along an epipolar line (Fig. 2) and disparity values lose their clear interpretation. Therefore, it is not convenient to define minimum and maximum value of disparity (along epipolar line) for correspondence search range specification.

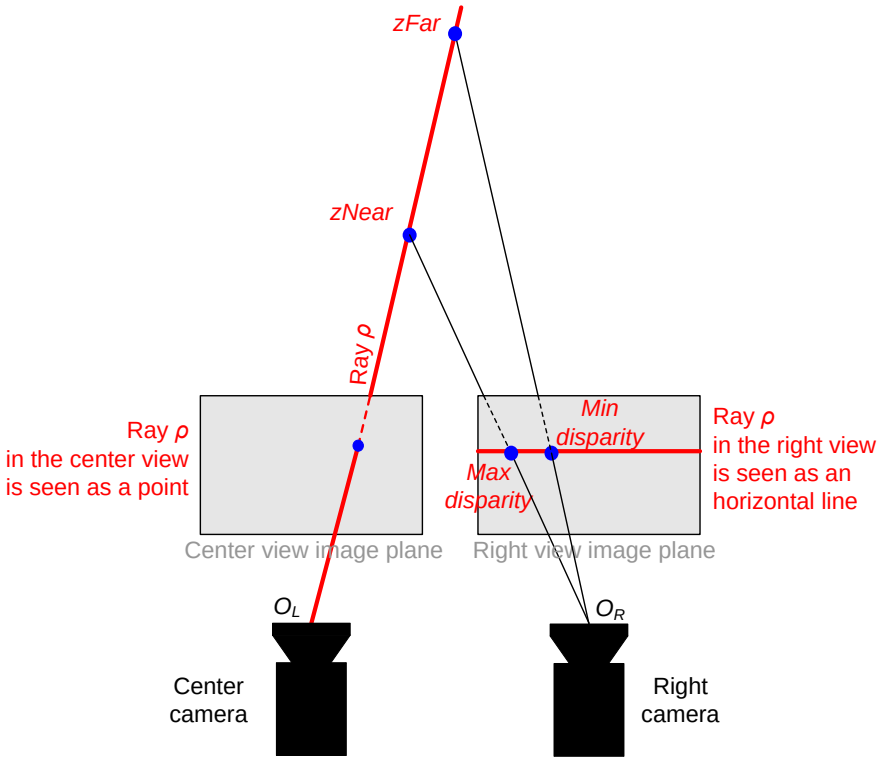

Fig. 1. Search correspondence range in the case of linear alignment of the cameras (axes of the cameras are parallel).

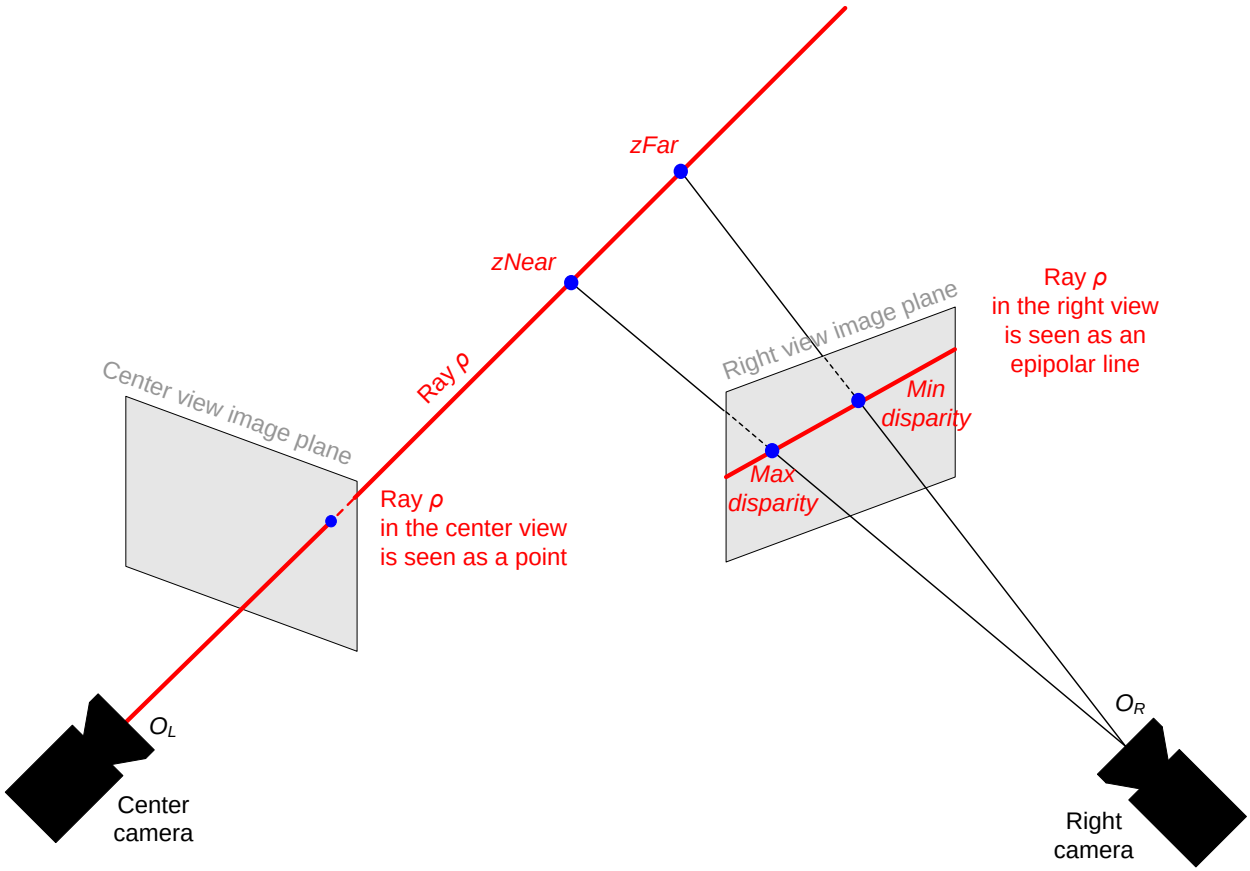

Fig. 2. Search correspondence range in the case of arbitrary camera setup.

Moreover, synthesis of virtual views in View Synthesis Reference Sortware (VSRS) [2] requires only two z-distances which are used to denormalize the depth map according to (1)

$$z = \frac{1}{\frac{DepthValue}{MaxDepthValue} \cdot \left(\frac{1}{zNear} - \frac{1}{zFar}\right) + \frac{1}{zFar}} \tag{1}$$

Those two z-distances are zFar and zNear values. It is quite easy to obtain zNear and zFar values for a given scene either form camera parameters or form knowledge about the geometry of the scene.

3 Z-distance-based Search Range

Due to reasons stated above, we propose a different way of defining correspondence search range in DERS, based on z-distance. In our proposal, instead of minimum and maximum disparity values, zNear and zFar values are directly given as configuration parameters. Along with those, the number of depth steps between zNear and zFar is given to define granularity of the correspondence search range.

4 New configuration parameters

Following additional configuration parameters have been added for z-distance-based search range specification.

```
NearestDepthValue                   -26.0
FarthestDepthValue                  -254.0

NearestSearchDepthValue             -26.0
FarthestSearchDepthValue            -254.0

NumberOfDepthSteps                  200
```

NearestDepthValue

Double , default: 0.0

Specifies the nearest depth value from camera (depth type 0) or the origin of 3D space for depth map normalization (depth type 1).

FarthestDepthValue

Double , default: 0.0

Specifies the farthest depth value from camera (depth type 0) or the origin of 3D space for depth map normalization (depth type 1).

NearestSearchDepthValue

Double , default: 0.0

Specifies the nearest depth value from camera(depth type 0) or the origin of 3D space for correspondence search (depth type 1).

FarthestSearchDepthValue

Double , default: 0.0

Specifies the farthest depth value from camera (depth type 0) or the origin of 3D space for correspondence search (depth type 1).

NumberOfDepthSteps

Unsigned Int , default: 100

Specifies the number of depth values between nearest and the farthest depth value from camera or the origin of 3D space for correspondence search.

5 Conclusions

A new way of defining correspondence search range in DERS have been proposed. The proposed way is more user friendly in cases of arbitrary camera setups (non-linear camera arrangement)

We recommend to include this new way of providing correspondence search range (as an alternative to the old method) in the next release of DERS Software.

6 References

[1] K. Wegner, O. Stankiewicz, M. Tanimoto, M. Domanski, „Enhanced Depth Estimation Reference Software (DERS) for Free-viewpoint Television" ISO/IEC JTC1/SC29/WG11 MPEG2013/M31518, October 2013, Geneva, Switzerland.

[2] K. Wegner, O. Stankiewicz, M. Tanimoto, M. Domanski, „Enhanced View Synthesis Reference Software (VSRS) for Free-viewpoint Television" ISO/IEC JTC1/SC29/WG11 MPEG2013/M31519, October 2013, Geneva, Switzerland.