

The PUTK<sup>2</sup> - PUT Kinect 1 & Kinect 2 data set is publicly available for non-commercial, research purposes. By downloading the database researcher(s) agrees to the following restrictions:

1. The database cannot be further distributed, copied or published in any way.
2. All submitted papers or any publicly available text using the PUTK<sup>2</sup> must cite the following paper:

**"Towards evaluation of visual navigation algorithms on RGB-D data from the first and second generation Kinect"** – Marek Kraft, Michał Nowicki, Adam Schmidt, Michał Fularz, and Piotr Skrzypczyński, Machine Vision and Applications, 2016.

Bibtex citation:

```
@incollection{
  year={2016},
  isbn={},
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  title={Towards evaluation of visual navigation algorithms on RGB-D data
  from the first and second generation Kinect},
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  keywords={},
  author={Kraft, Marek and Nowicki, Michał and Schmidt, Adam and Fularz,
  Michał and Skrzypczyński, Piotr},
  pages={}
}
```

Contact [irm@put.poznan.pl](mailto:irm@put.poznan.pl) for any information regarding the database.

## PUTK<sup>2</sup> - PUT Kinect 1 & Kinect 2 data set documentation

The database contains following folders and files:

- ❖ **sequence\_X\_Kinect\_vY** folder, which contains information about trajectory number X and Kinect in version Y:
  - **depth** – folder which contains depth images registered by the Kinect sensor,
  - **rgb** – folder which contains colour (RGB) images registered by the Kinect sensor,
  - **groundtruth.txt** – file which stores ground-truth information about the robot orientation and position during the experiment.

Each **groundtruth.txt** has the same structure as data in TUM RGB-D Dataset ([link](#)):

- ❖ each line represents one robot position (values are separated with the space “ ” sign):
  - first value is the frame number (**no**),
  - next three values denotes position of a Kinect in metres with regard to the centre of the coordinate system (**tx**, **ty**, **tz**),
  - last four values represents the rotation of the Kinect in the global coordinate system (**qx**, **qy**, **qz** and **qw**).

The parameters of cameras are stored in [Kinect1.xml](#) and [Kinect2.xml](#) and are equal to either Kinect v1 parameters:

```
<focalLength fu="532.77250" fv="531.85745"/>
<focalAxis Cu=" 312.23007" Cv="260.11708"/>
<rgbDistortion k1="0.16054" k2="-0.24682" p1="0.00136" p2="0.00149" k3="0.00000"/>
```

or Kinect v2 parameters:

```
<focalLength fu="1078.68499" fv="1076.4742562"></focalLength>
<focalAxis Cu="952.6592286" Cv="530.7386644"></focalAxis>
<rgbDistortion k1="0.02712800285" k2="-0.003876435388" p1="-0.0003782667962"
p2="-0.002409935964" k3="0.05862808573"></rgbDistortion>
```

The sequences can be obtained under following links:

- ❖ [PUTKK Sequence 1 Kin v1](#)
- ❖ [PUTKK Sequence 1 Kin v2](#)
- ❖ [PUTKK Sequence 2 Kin v1](#)
- ❖ [PUTKK Sequence 2 Kin v2](#)
- ❖ [PUTKK Sequence 3 Kin v1](#)
- ❖ [PUTKK Sequence 3 Kin v2](#)
- ❖ [PUTKK Sequence 4 Kin v1](#)

- ❖ [PUTKK Sequence 4 Kin v2](#)
- ❖ [PUTKK Sequence 5 Kin v1](#)
- ❖ [PUTKK Sequence 5 Kin v2](#)
- ❖ [PUTKK Sequence 6 Kin v1](#)
- ❖ [PUTKK Sequence 6 Kin v2](#)
- ❖ [PUTKK Sequence 7 Kin v1](#)
- ❖ [PUTKK Sequence 7 Kin v2](#)
- ❖ [PUTKK Sequence 8 Kin v1](#)
- ❖ [PUTKK Sequence 8 Kin v2](#)

Additional information:

- ❖ the quick preview of the normal registered sequence are provided in the youtube:
  - [PUTKK - Sequence 1 Kinect v1](#)
  - [PUTKK - Sequence 1 Kinect v2](#)
  - [PUTKK - Sequence 2 Kinect v1](#)
  - [PUTKK - Sequence 2 Kinect v2](#)
  - [PUTKK - Sequence 3 Kinect v1](#)
  - [PUTKK - Sequence 3 Kinect v2](#)
  - [PUTKK - Sequence 4 Kinect v1](#)
  - [PUTKK - Sequence 4 Kinect v2](#)
- ❖ the quick preview of the registered sequence with different speeds are provided in the youtube:
  - [PUTKK - Sequence 5 Kinect v1](#)
  - [PUTKK - Sequence 5 Kinect v2](#)
  - [PUTKK - Sequence 6 Kinect v1](#)
  - [PUTKK - Sequence 6 Kinect v2](#)
  - [PUTKK - Sequence 7 Kinect v1](#)
  - [PUTKK - Sequence 7 Kinect v2](#)
  - [PUTKK - Sequence 8 Kinect v1](#)
  - [PUTKK - Sequence 8 Kinect v2](#)
- ❖ the scene reconstructed with the ground truth information is also available:
  - [PUTKK - Sequence 2 Kinect v1 - Scene reconstruction from ground truth](#)
  - [PUTKK - Sequence 2 Kinect v2 - Scene reconstruction from ground truth](#)
- ❖ to get the full depth resolution images have to be loaded as 16-bit. Sample code snippet for this operation (using OpenCV):

```
cv::Mat depthImage = cv::imread(filename, CV_LOAD_ANY_DEPTH);
```

- ❖ the values in the depth image are given in millimetres,
- ❖ sample code snippet for undistorting the images from Kinect (using OpenCV):

```

// focal lengths
#define fx 517.3
#define fy 516.5

// principal point
#define cx 318.6
#define cy 255.3

// Kinect image
#define HEIGHT 480
#define WIDTH 640

// Distortion coefficients
#define k1 0.2624
#define k2 -0.9531
#define p1 -0.0054
#define p2 0.0026
#define k3 1.1633

float coeffs[5] = {k1, k2, p1, p2, k3 };
cv::Mat distCoeffs = cv::Mat(1, 5, CV_32FC1, &coeffs);

float cm[3][3] = {{fx, 0, cx},{0, fy, cy},{0, 0, 1}};
cv::Mat cameraMatrix = cv::Mat(3, 3, CV_32FC1, &cm);

double X,Y,Z;
for(int v = 0; v < HEIGHT; v++)
{
    for (int u = 0; u < WIDTH; u++)
    {
        if ( depth.at<uint16_t>(v,u) != 0 )
        {
            Z = depth.at<uint16_t>(v,u);

            cv::Mat src = cv::Mat(1,1,CV_32FC2), dst = cv::Mat(1,1,CV_32FC2);
            src.at<cv::Vec2f>(0,0)[0] = u;
            src.at<cv::Vec2f>(0,0)[1] = v;

            cv::undistortPoints(src,dst,cameraMatrix,distCoeffs);

            X = dst.at<cv::Vec2f>(0,0)[0] * Z;
            Y = dst.at<cv::Vec2f>(0,0)[1] * Z;

            // Point (X,Y,Z) in mm
        }
    }
}

```