Stereo kalibracija kamera s ribljim okom

Diplomski seminar

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Mentor: **Izv. prof. dr. sc. Siniša Šegvić**

Lipanj 2016.

Sadržaj

1. **Kamera s ribljim okom**
2. Kalibracija kamere s ribljim okom
3. Stereo kalibracija kamera s ribljim okom

1. Kamera s ribljim okom

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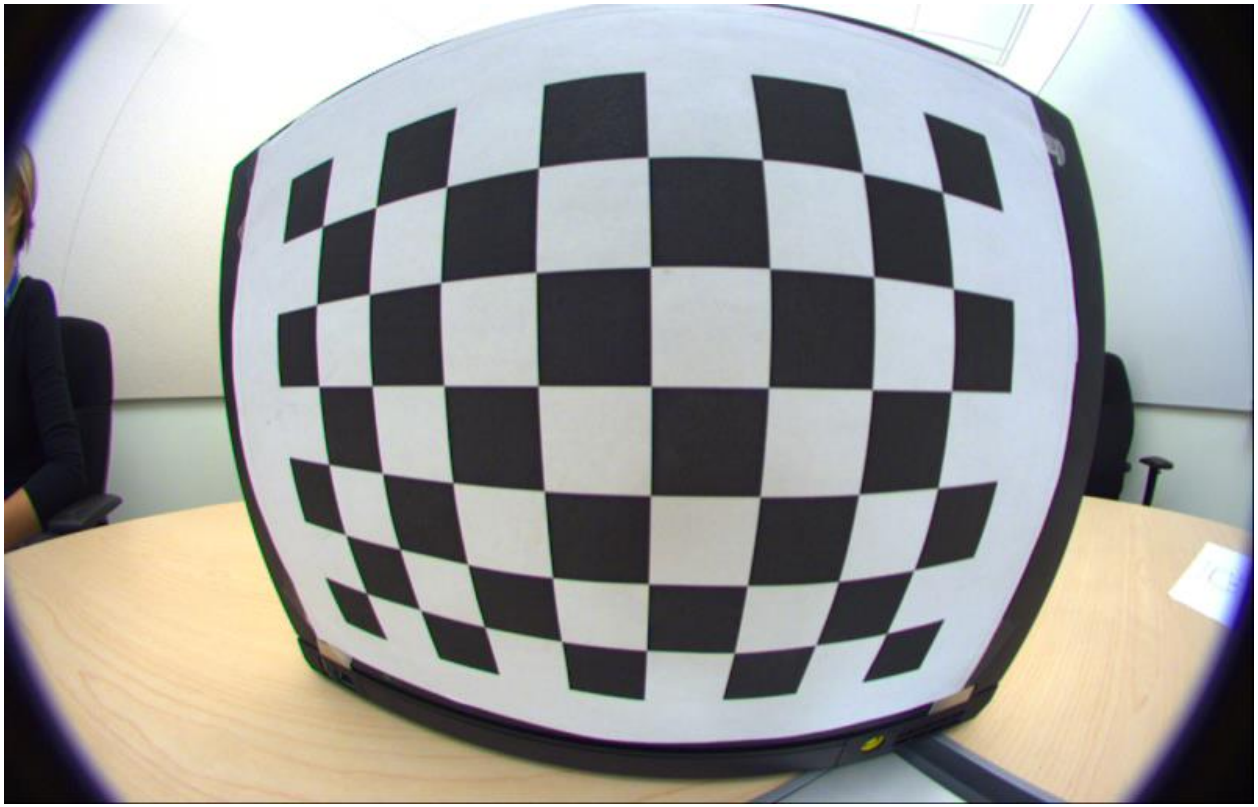

1. Kamera s ribljim okom: model stvaranja slike

- Perspektivni model stvaranja slike
- Radijalno simetrični model stvaranja slike

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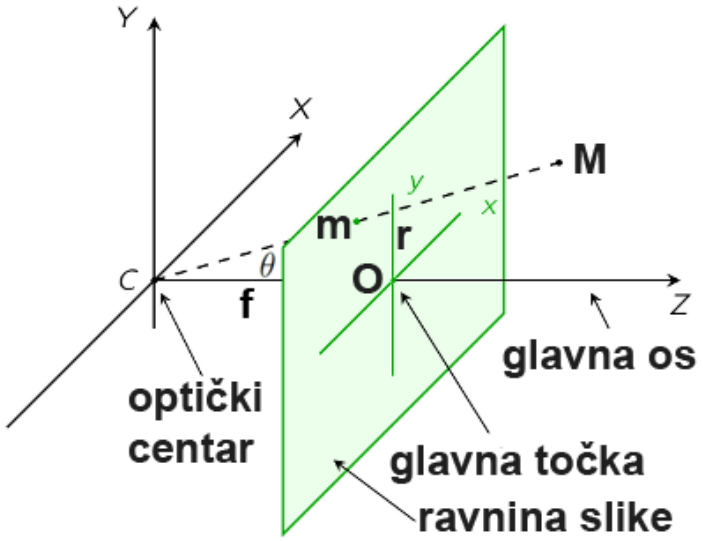
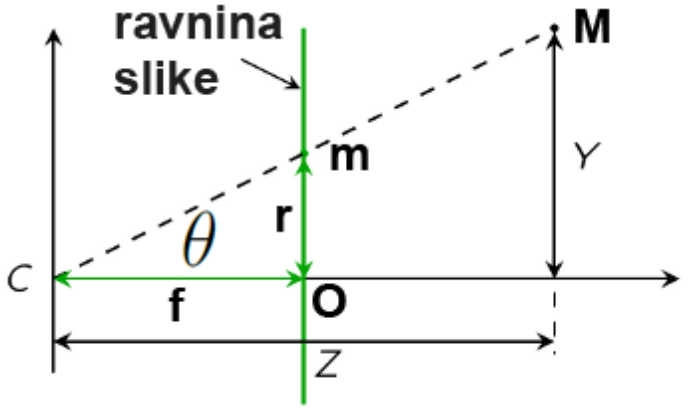
- Perspektivni model stvaranja slike





- Perspektivna projekcija: $r = f\ tan(\theta)$

$$\alpha m = PM$$

$$\alpha m = K[R\ t]M$$

$$K = \begin{bmatrix} f_x & x_\gamma & u_0 \\ 0 & f_y & v_0 \\ 0 & 0 & 1 \end{bmatrix}$$

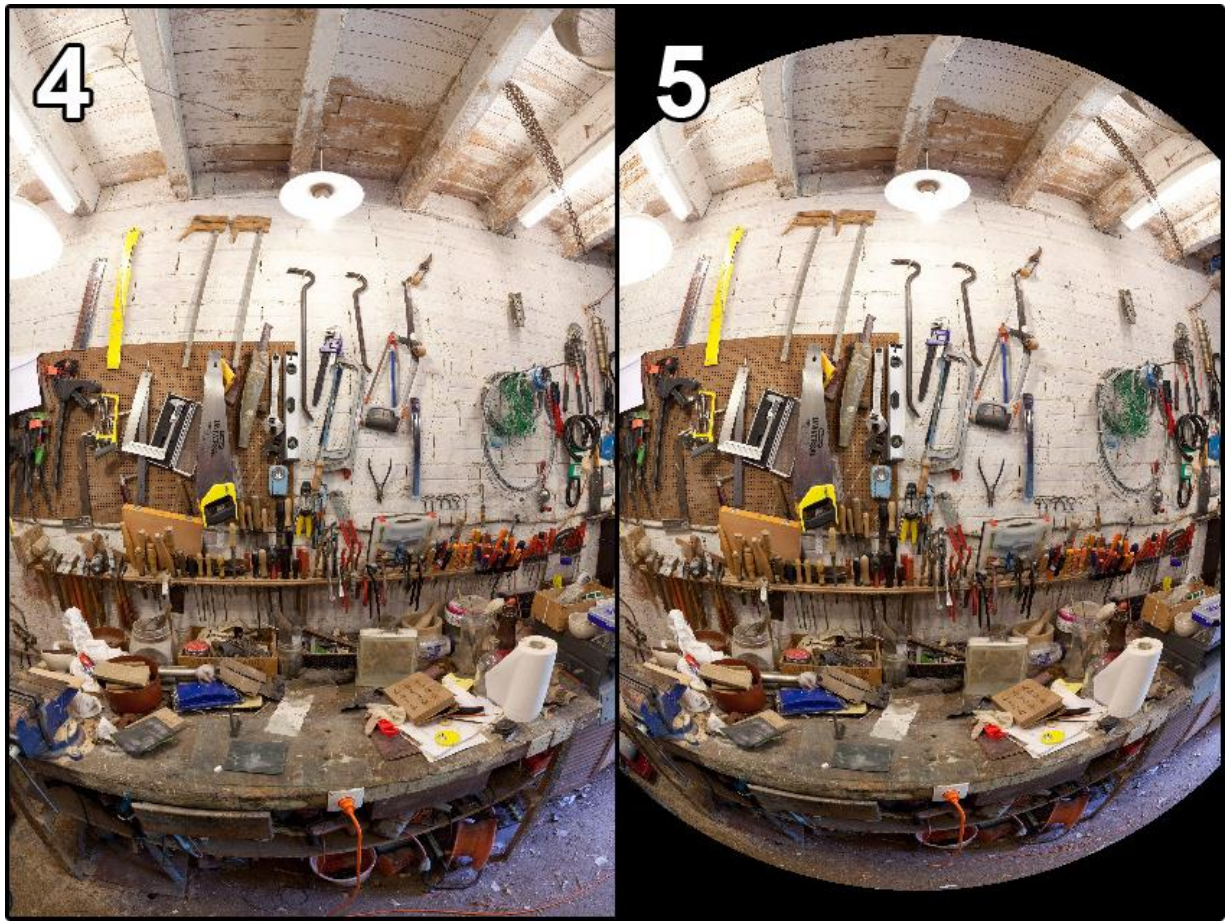
1. Kamera s ribljim okom: model stvaranja slike

- Radijalno simetrični model stvaranja slike

Perspektivna projekcija	Stereografska projekcija	Ekvidistantna projekcija
$r = f\ tan(\theta)$	$r = 2\ f\ tan(\theta\ /\ 2)$	$r = f\ \theta$

1. Kamera s ribljim okom: model stvaranja slike

- Radijalno simetrični model stvaranja slike



Ekvisolidna projekcija

$r = 2f * sin(\theta / 2)$

Ortografska projekcija

$r = f\, sin(\theta)$

Sadržaj

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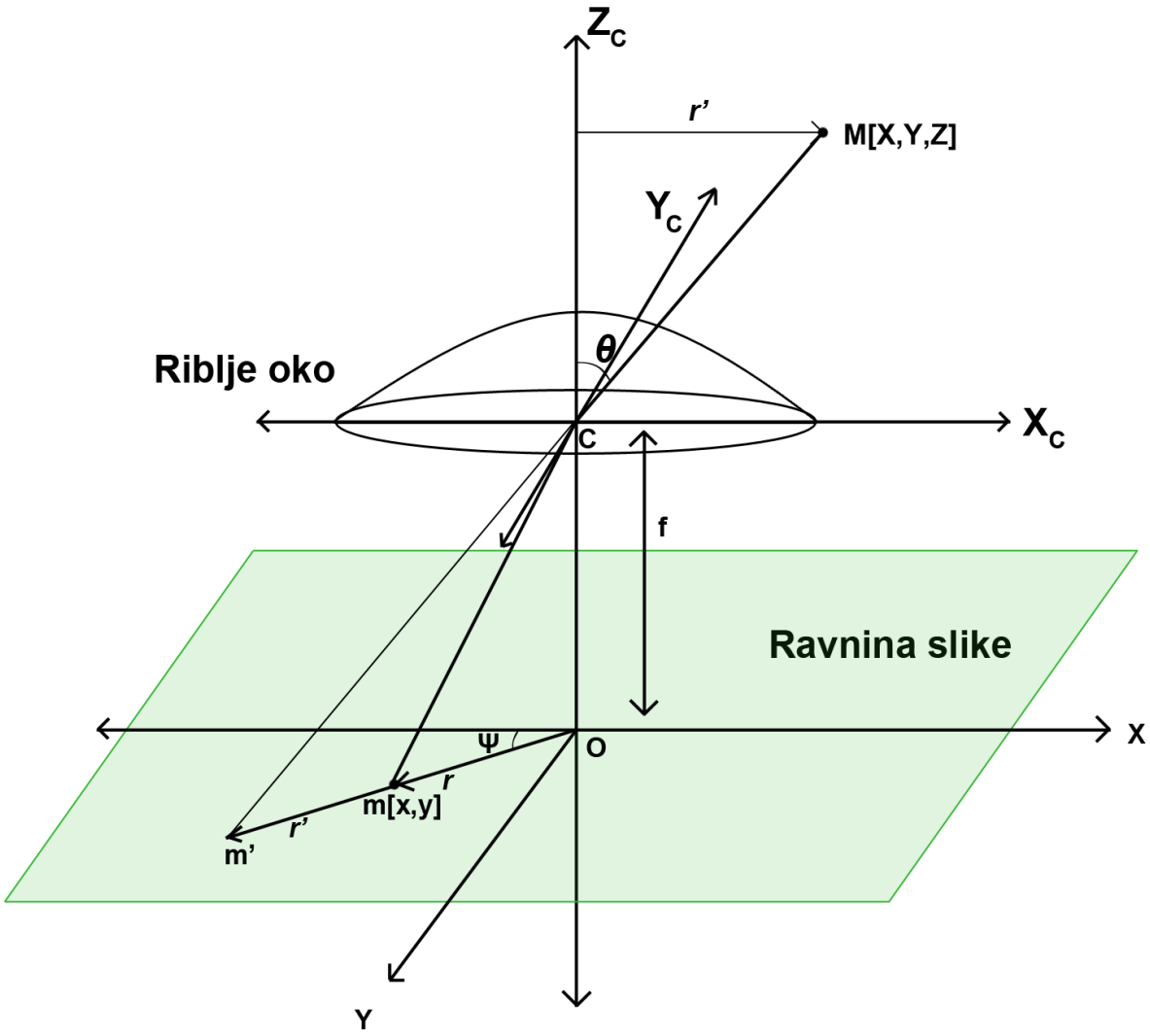
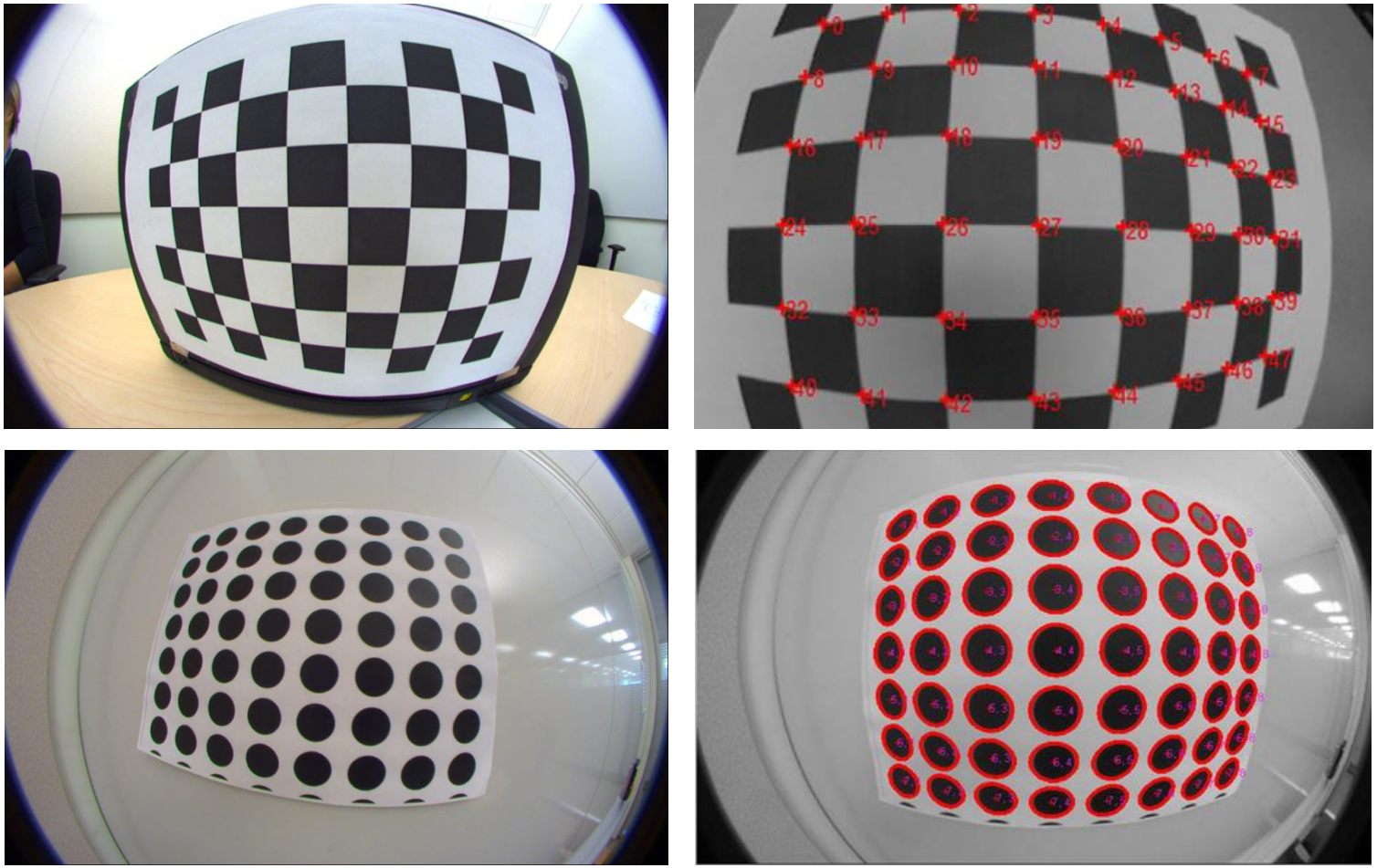
2. Kalibracija kamere s ribljim okom



2. Kalibracija kamere s ribljim okom

- Kalibracija kamera s ribljim okom pomoću uzorka



2. Kalibracija kamere s ribljim okom

- Funkcije izobličenja razvijene posebno za kamere s ribljim okom:

  - **Polinomni model ribljeg oka**

    - $\theta = \sum_{i=1}^{\infty} k_n r^n = k_1 r + k_2 r^2 + \ldots$

  - **Model vidnog polja FOV**

    - $r_d = \frac{1}{\omega} tan^{-1}(2r_u \tan\left(\frac{\omega}{2}\right))$

  - **Transformacija ribljeg oka**

    - $r_d = s * ln(1 + \lambda r_u)$

  - **Model diobe**

    - $r_d = \frac{(l+1)sin\,\theta}{l + cos\,\theta}$

Sadržaj

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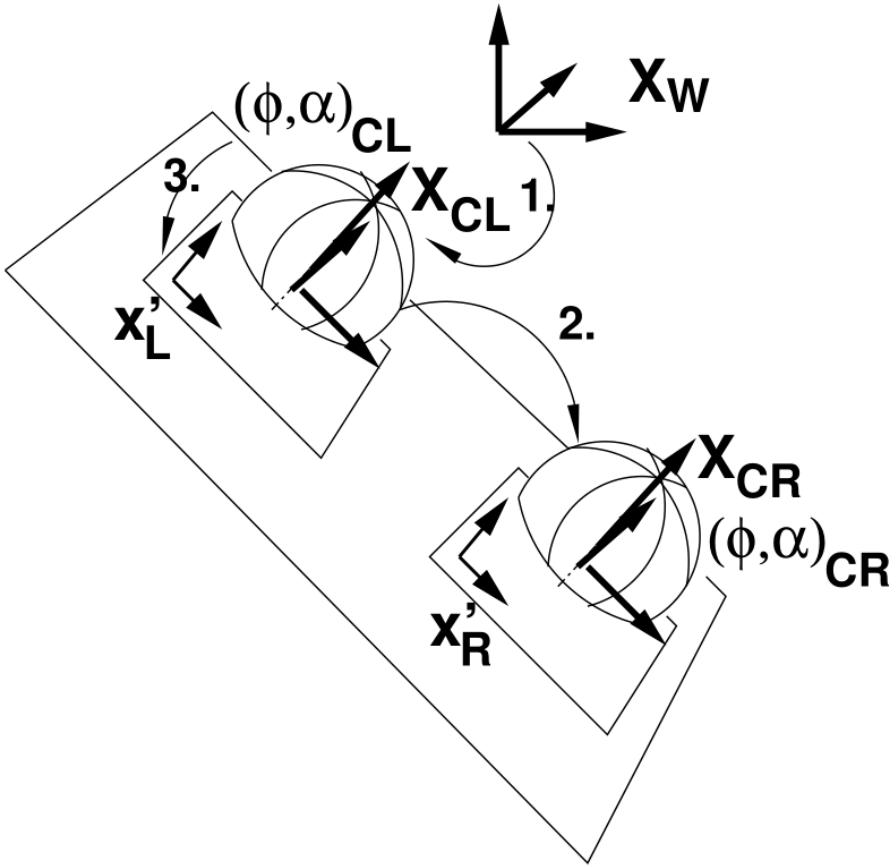
3. Stereo kalibracija kamere: rektifikacija

- Vanjska i relativna orijentacija



- Vanjska orijentacija:

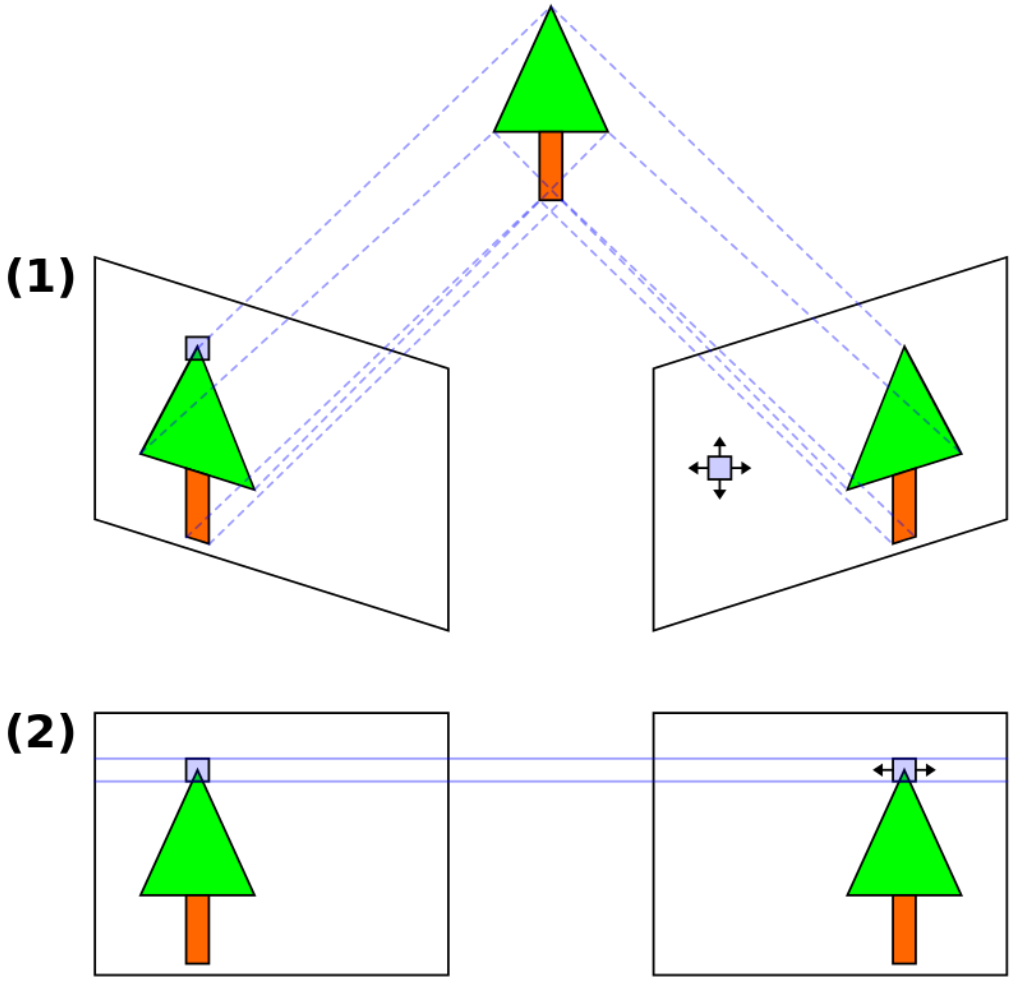
$$\boldsymbol{X}_{CL} = \boldsymbol{R}_{W,CL}(\boldsymbol{X}_W - \boldsymbol{t}_{W,CL})$$

- Relativna orijentacija:

$$\boldsymbol{X}_{CR} = \boldsymbol{R}_{CL,CR}(\boldsymbol{X}_{CL} - \boldsymbol{t}_{CL,CR})$$

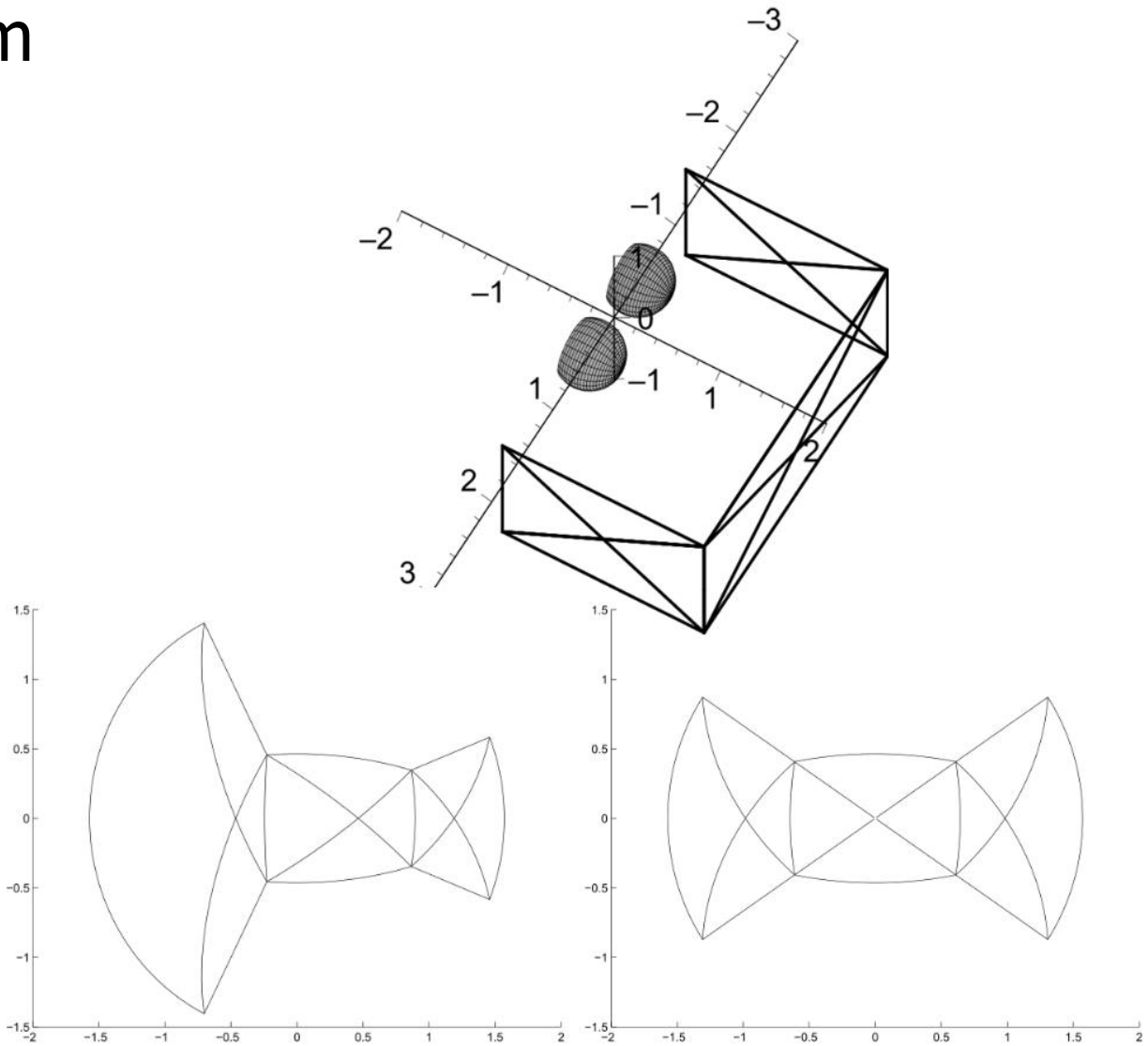
3. Stereo kalibracija kamere: rektifikacija

- Koncept



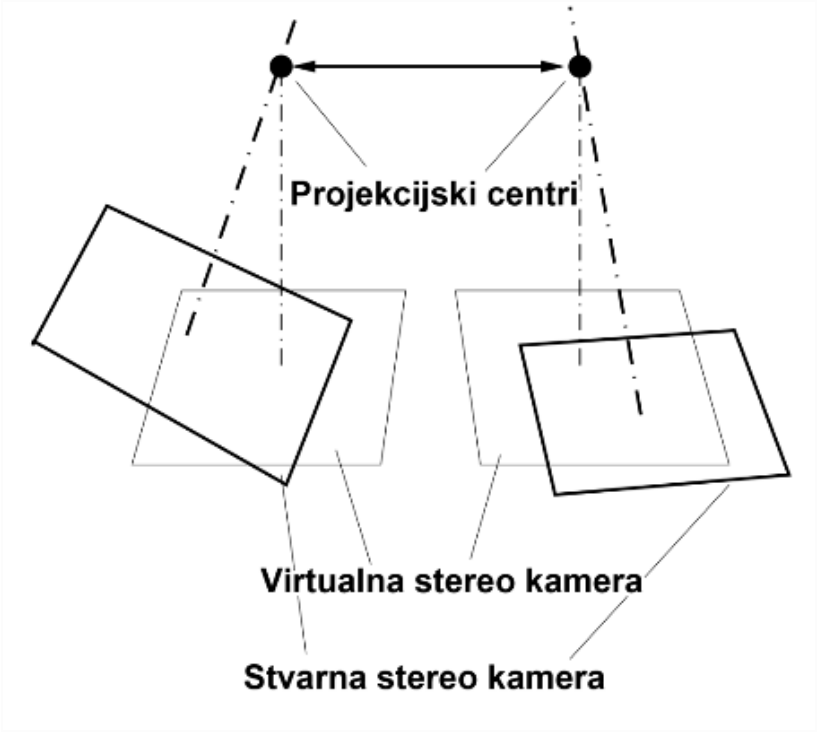
3. Stereo kalibracija kamere: rektifikacija

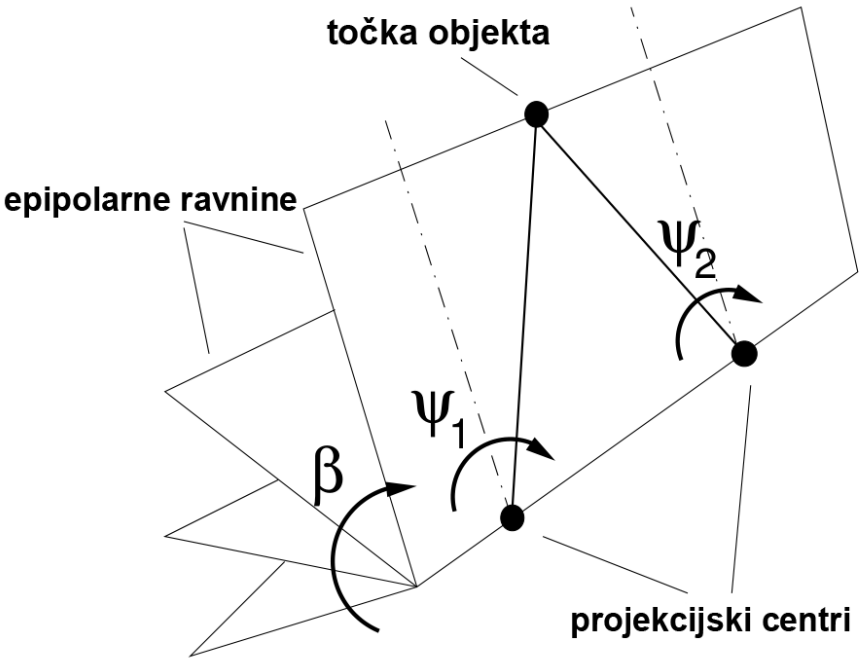
- Problem



3. Stereo kalibracija kamere: rektifikacija

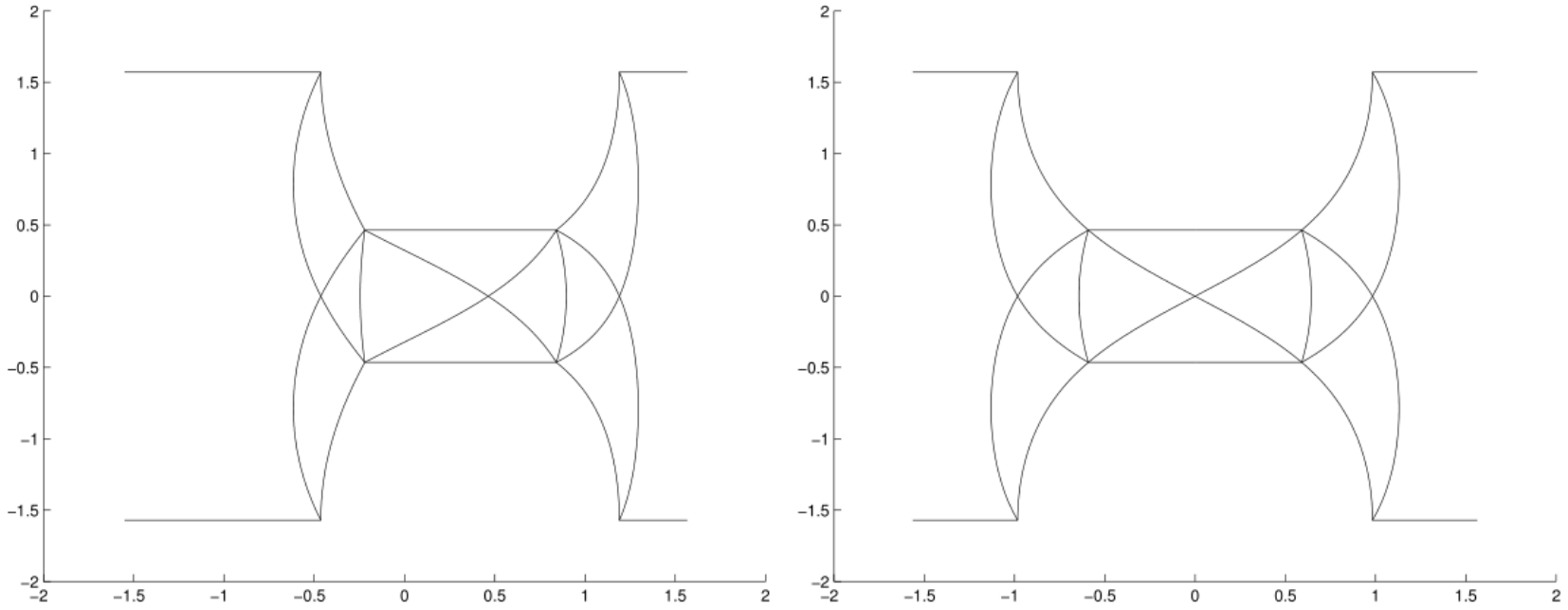
- Epipolarna rektifikacija





3. Stereo kalibracija kamere: rektifikacija

- Epipolarna rektifikacija



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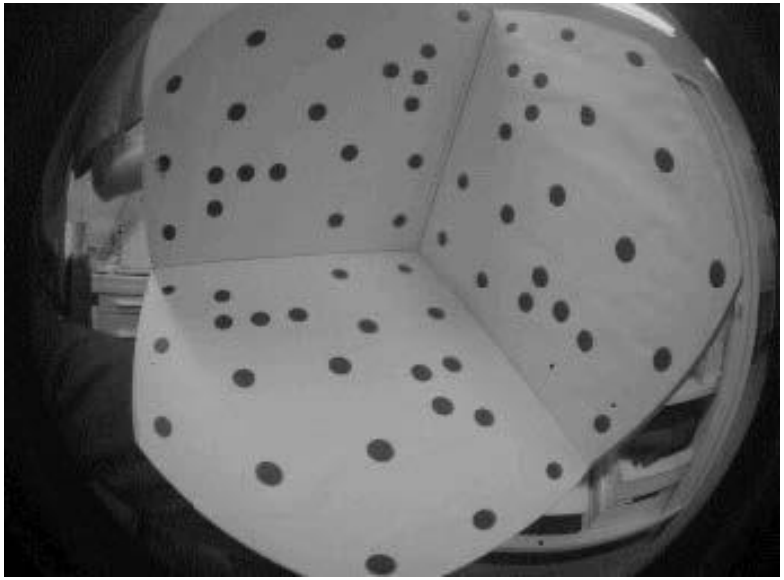


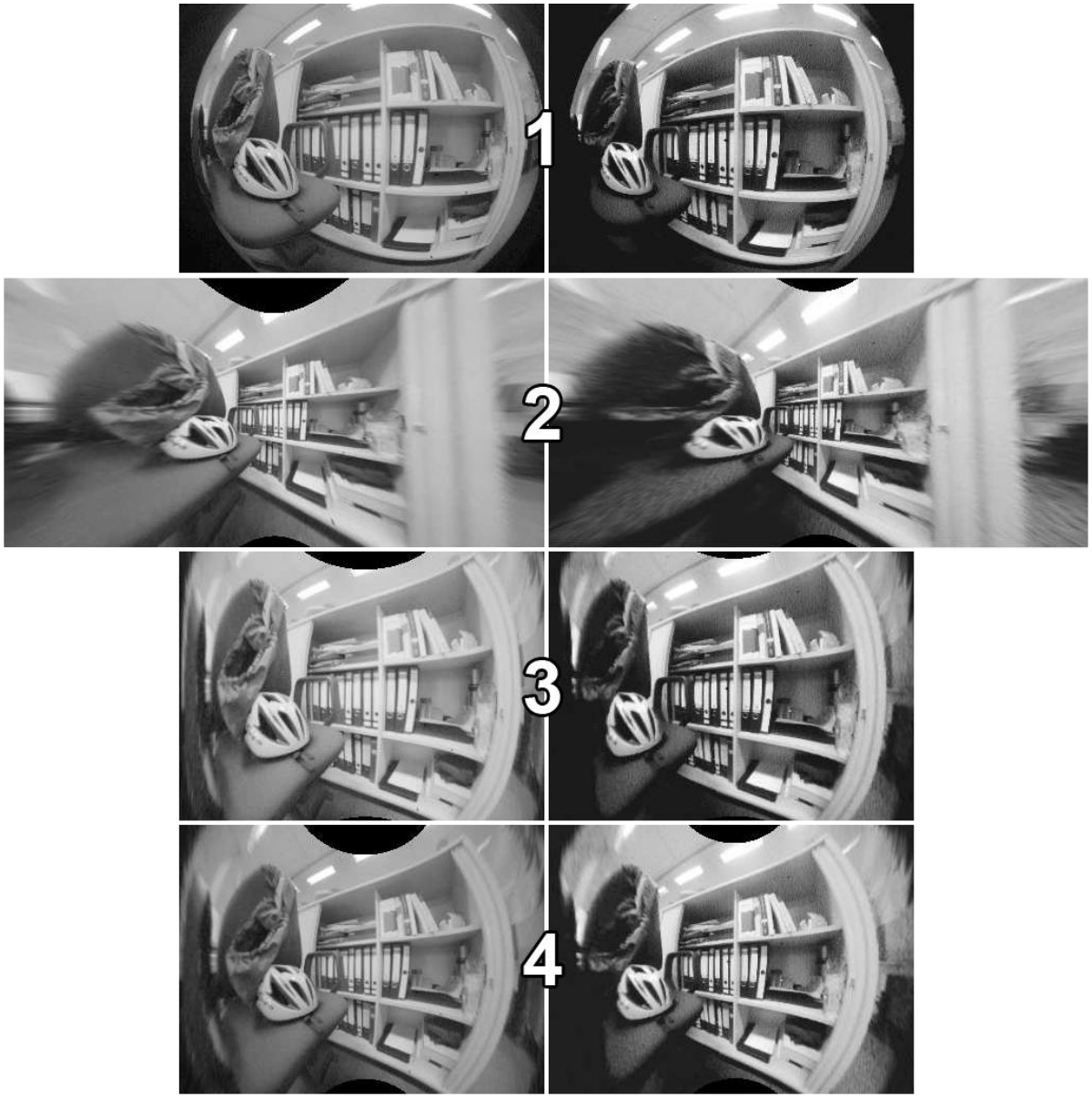
- Parametri:
  - vrijednosti $\boldsymbol{x}'_{L_{ij}}$ i $\boldsymbol{x}'_{R_{ij}}$ (slike j, točke i)
  - intrinsični parametri $\hat{\boldsymbol{p}}_{CL}$ i $\hat{\boldsymbol{p}}_{CR}$
  - ekstrinsični parametri $(\hat{\boldsymbol{R}}, \hat{\boldsymbol{t}})_{W,CL_j}$
  - omjer $(\hat{\boldsymbol{R}}, \hat{\boldsymbol{t}})_{CL,CR}$
  - koordinate točaka $\hat{\boldsymbol{X}}_{W_i}$

- Estimacija parametara:

$$\Omega = \sum_i \sum_j \left[\boldsymbol{x}'_{L_{ij}} - \boldsymbol{f}(\hat{\boldsymbol{p}}_{CL}, (\hat{\boldsymbol{R}}, \hat{\boldsymbol{t}})_{W,CL_j}, \hat{\boldsymbol{X}}_{W_i}) \right]^2 + \left[\boldsymbol{x}'_{R_{ij}} - \boldsymbol{f}\left(\hat{\boldsymbol{p}}_{CR}, (\hat{\boldsymbol{R}}, \hat{\boldsymbol{t}})_{W,CL_j}, (\hat{\boldsymbol{R}}, \hat{\boldsymbol{t}})_{CL,CR}, \hat{\boldsymbol{X}}_{W_i} \right) \right]^2$$

3. Stereo kalibracija kamere

- Primjer



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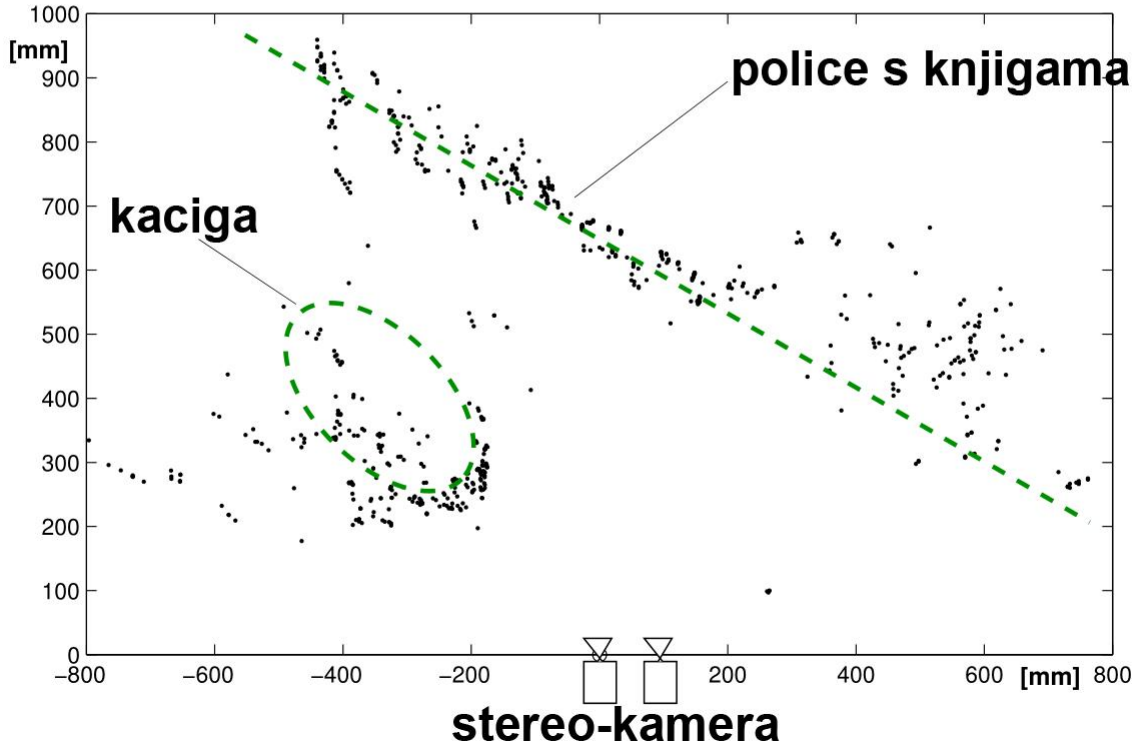

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