Vision-based localization

Borna Bešić & Fabian Stiller

Project goals

- Regress pose vector from AIS Perception Car image data using a deep neural network
- Compare two input models:
  - only front camera
  - six cameras covering 360°
- Smooth the trajectory given by the neural network

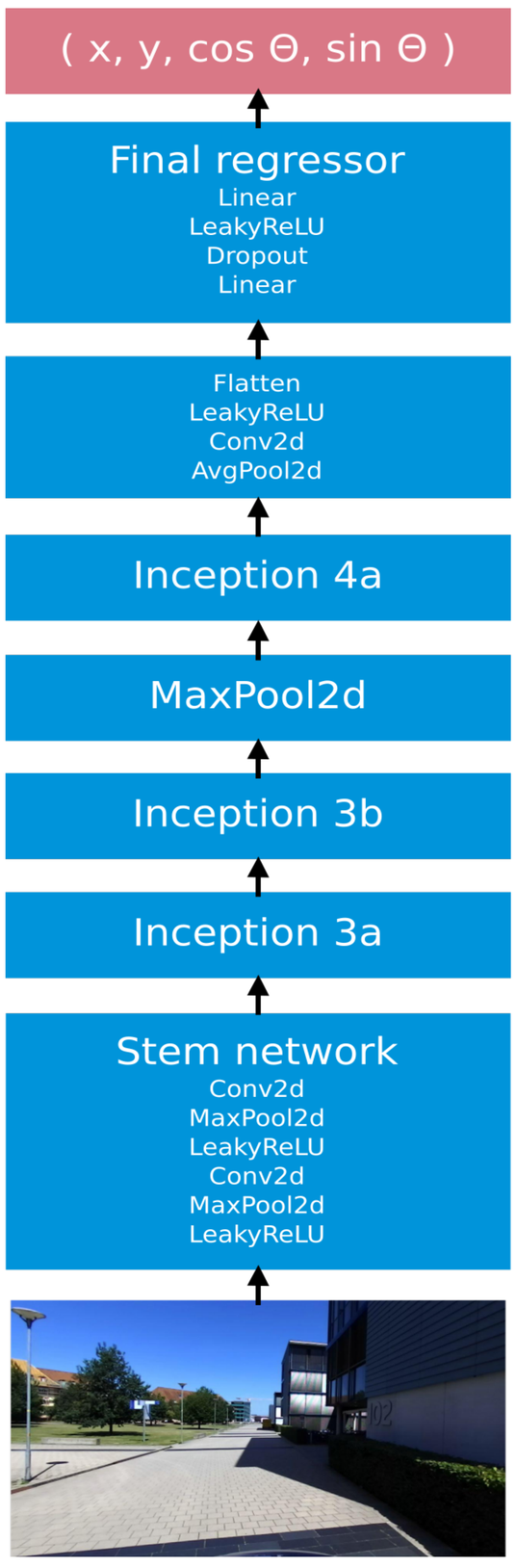
Dataset

- ~ 9000 poses around Faculty of Engineering Campus with GPS data
- Spatial extent: 300 m x 300 m (90000 m^2)
- For six cameras input model, images were concatenated along the channel axis resulting in a single image with 3 x 6 = 18 channels

Neural network architecture

- *PoseNet* up to the first regressor
- Model size: ~ 9 MiB
- Loss function: combined position vector L2 loss and orientation vector L2 loss with a weighting factor β

$$\mathbf{p} = (\mathbf{x}, \mathbf{q})$$
$$\mathbf{x} = (x, y)$$
$$\mathbf{q} = (\cos\theta, \sin\theta)$$
$$L(\mathbf{p}, \hat{\mathbf{p}}) = \|\mathbf{x} - \hat{\mathbf{x}}\|_2 + \beta \left\| \mathbf{q} - \frac{\hat{\mathbf{q}}}{\|\hat{\mathbf{q}}\|_2} \right\|_2$$



Experimental results

- Median position and orientation errors:
  - Front camera: 3.84 m, 3.97°
  - All cameras: 4.77 m, 2.71°