

1st homework: Stereo vision

- Deadline: 31st of October
- 3 Subtasks: Algorithms, Display, Evaluation
- cg.elte.hu/~sensing/slides/hw_assignments
- Submission:
 - eiirai@inf.elte.hu
 - Only the source files and the Documentation
(no need for project files and executables and other binaries)
(minimize package size!)

1st homework – Subtask 1: Algorithms (45%)

- Use C++, Python / JupyterLab, Matlab or whatever.
- Read images using [OpenCV](#) or a similar tool.
- Design and implement these stereo-matching schemes:
 - **Naive stereo** matching. (10%)
 - **Dynamic Programming (DP)** approach. (35%)
 - *Note*: make the parameters (window size, weights) tunable.
 - *Optional*: compare your solution to existing implementations (e.g. in OpenCV) or implement a new one yourself! (Extra +5..+10%)

1st homework – Subtask 2: 3D display (25%)

- Implement a tool that converts a disparity map to 3D object:
 - Point cloud (10%)
 - **Oriented** point cloud (8%)
(i.e., figure out a way to assign **surface normals** to the points)
 - Triangulated surface (7%)
(i.e., connect the points, as vertices, by indices to form a 3D triangle surface)
- Suggestion:
 - PLY file format ([https://en.wikipedia.org/wiki/PLY_\(file_format\)](https://en.wikipedia.org/wiki/PLY_(file_format)))

1st homework – Subtask 3: Evaluation (30%)

- Take at least 6 pairs of stereo images and respective ground truth disparity maps
 - Middlebury, KITTI stereo evaluation dataset, etc.
- Compare
 - **Processing times** of various algorithms and/or parameterizations
 - **Quality** of estimated disparity maps, to ground truth disparity maps
 - Using various algorithms (Naive, DP, [OpenCV implementations, etc])
 - 3 Metrics:
 - SSD / MSE, RMSE, or SAD / MAD
 - SSIM – Structural Similarity Measure
 - + one of your choosing
 - -> **Plots, Figures, Diagrams**
 - Difference images (Estimated – Ground truth) (5%)
 - Tables and diagrams of **Processing times** and **Quality** evaluation metrics, etc. (20%)
- Evaluate & **find optimal** lambda and window size **parameters** for the DP algorithm (Extra +10%)
(i.e., Find the right parameter settings that produce outputs most similar to the ground truths. Use multiple pairs of inputs and ground truth.)
- Short but comprehensive documentation of the evaluation. (5%)