Project Replication

Digital Image Processing

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In Defense of Classical Image Processing: Fast Depth Completion on the CPU

Original Project

Resume

- The presented paper shows that a well designed image processing algorithm can outperform the data driven ones, the neural networks.
- The algorithm is fast and simple, running on a CPU. Yours evaluation was on the KITTI depth completion benchmark and at the submission time its managed to be on the first rank on KITTI test server.
- Also the algorithm doesn’t needs training data to perform that task

Depth Completion

- Depth completion is the task to convert a sparse depth map into a dense one.
- This algorithm was originally created to help visualize 3D objects detection results for AVOD.
- An accurate dense depth completion can help not just object detection but also SLAM algorithms that use point cloud input.

Paper approach

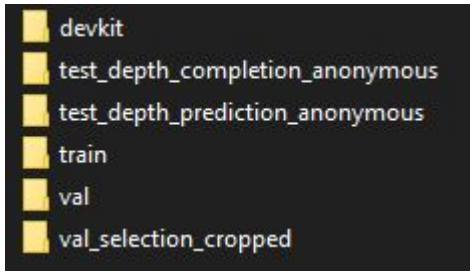
- This method takes advantage of the lidar projections by discarding the images
- The algorithm was evaluated at KITTI depth completion benchmarking dataset. This dataset shall allow a training of complex deep learning models for the tasks of depth completion and single image depth prediction.
- All methods of evaluation: iRMSE, RMSE, iMAE, MAE.

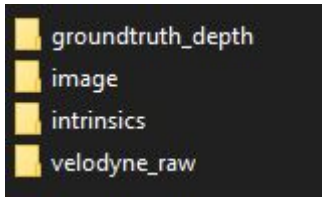
Replication and validation

Used Data

As described previously, we utilized the KITTI dpeth completion dataset. More specifically the “val_selection_cropped” data was utilized. This folder is divided into three main parts:

- groundtruth_depth: contains the correct depth maps;
- image: contains the RGB images that correspond to each depth map;
- velodyne_raw: contains the original sparse depth map obtained from the LIDAR sensor.





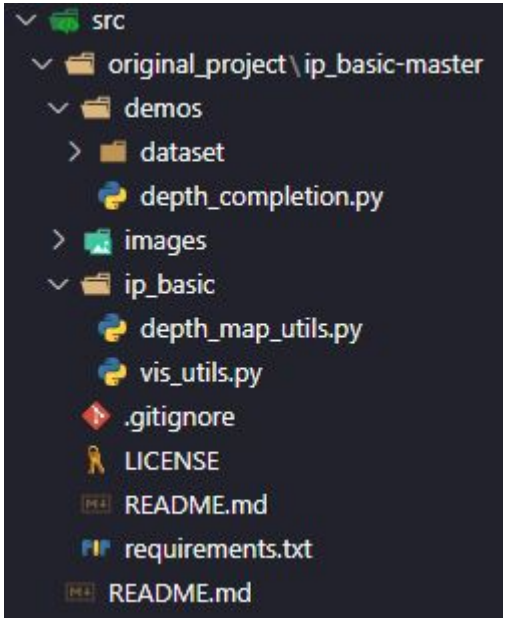
Code

Three main files:

- depth_completion.py
- depth_map_utils.py
- vis_utils.py

Required libraries:

- matplotlib
- numpy
- opencv-python
- pypng

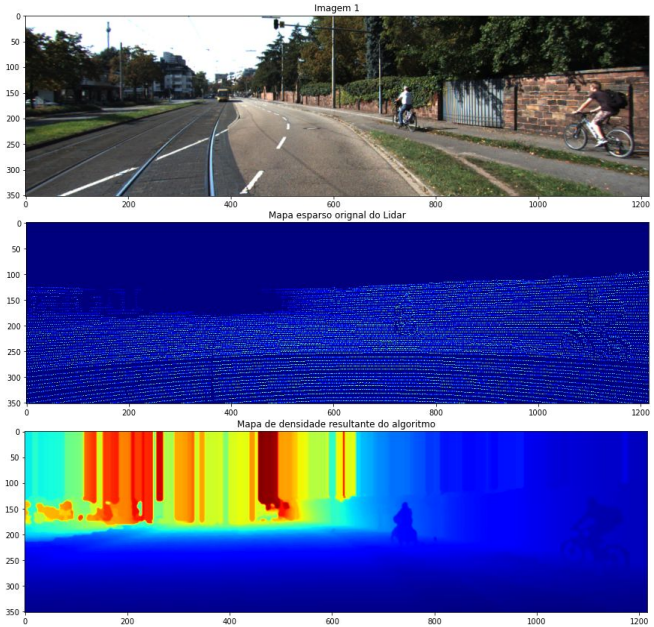


Implementation

The replication was done using the jupyter notebook tool:

- Original code was replicated in a notebook
- Dense depth maps were obtained from two selected dataset samples
- Metrics were extracted to validate the replication

Results



	Original Paper	Replication
MAE	0.303	0.305
RMSE	1.288	1.345
Execution Time (s)	0.011	0.011

Difficulties

At first, there were not many difficulties to replicate the work:

- Initially it was not clear which data were used to measure performance;
- It was also not clear which configuration of the algorithm the paper used;
- The name for the database files were a bit confusing.