

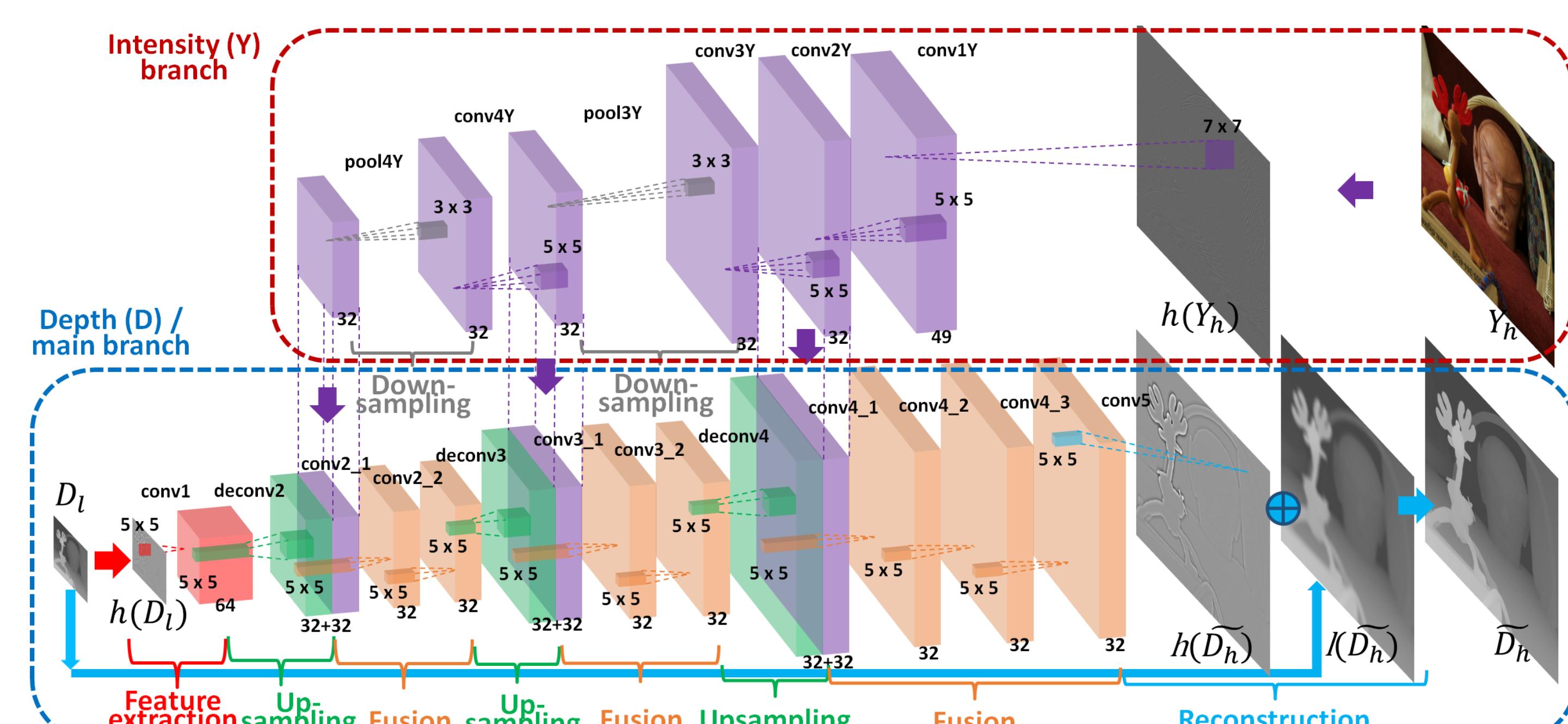
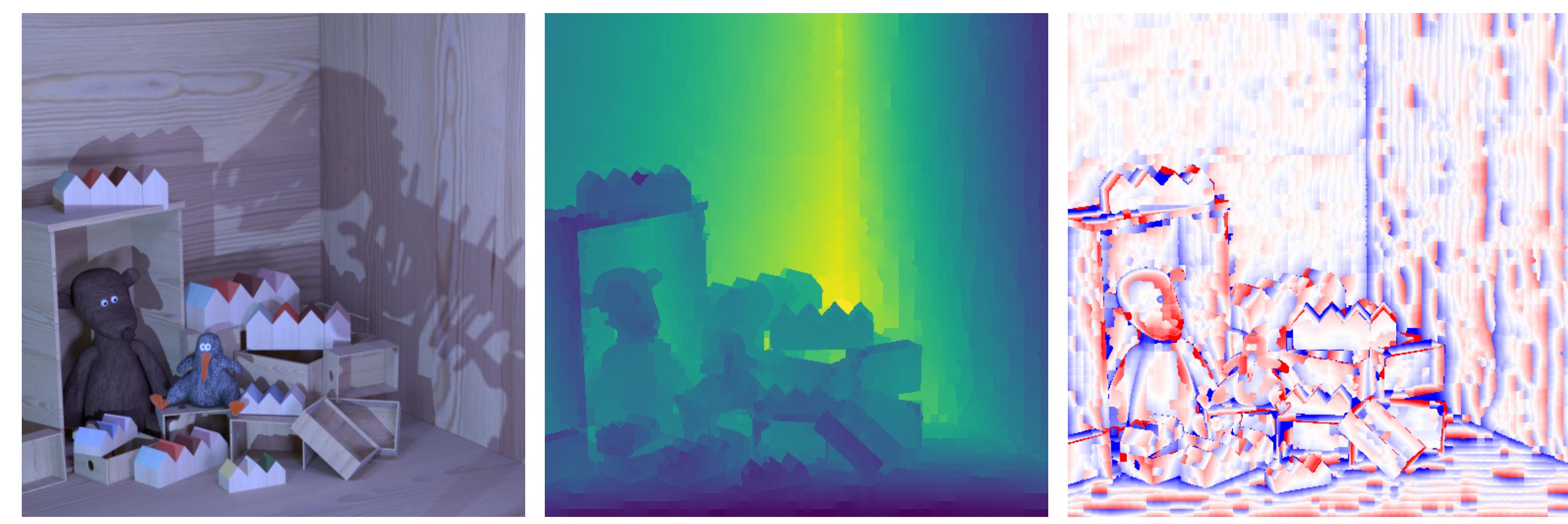
SMART3D

The SMART3D project seeks to find and develop competitive alternatives to LiDAR sensors, primarily through the investigation of PMD sensors and stereo camera sensors.

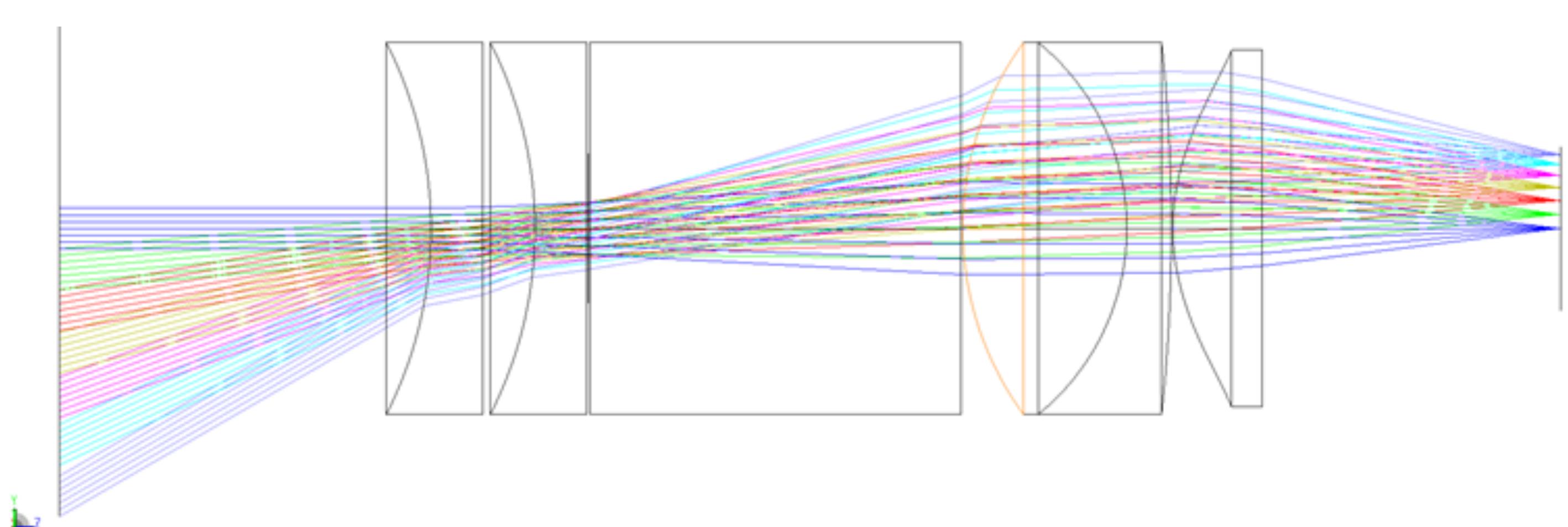
PMD (Photonic Mixing Device) sensors are short-to-medium range active sensors which typically have low resolution. However, image upscaling allows a higher quality map to be obtained. The system was proven to work with self-made scenes along with some synthetic scenes.



Physical setup (left): a low-res PMD sensor and a high-res color camera were used to capture each scene. Ground truth data provided by high-resolution LiDAR sensor (not pictured).



A "super-resolution" network (MSG-Net, Hui et al (2016)) was used for one method of image upscaling.



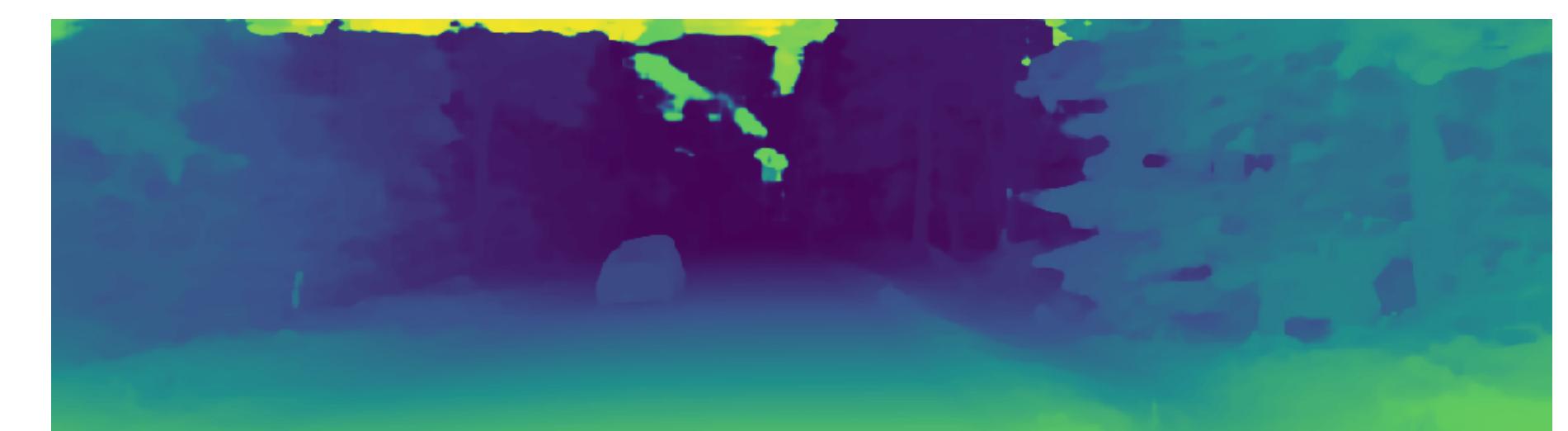
In addition to the network, a classical approach to upsampling was taken. This approach also performed similarly.

Stereo camera sensors are short-to-medium range passive sensors that rely on parallax to estimate distance, similar to human vision.

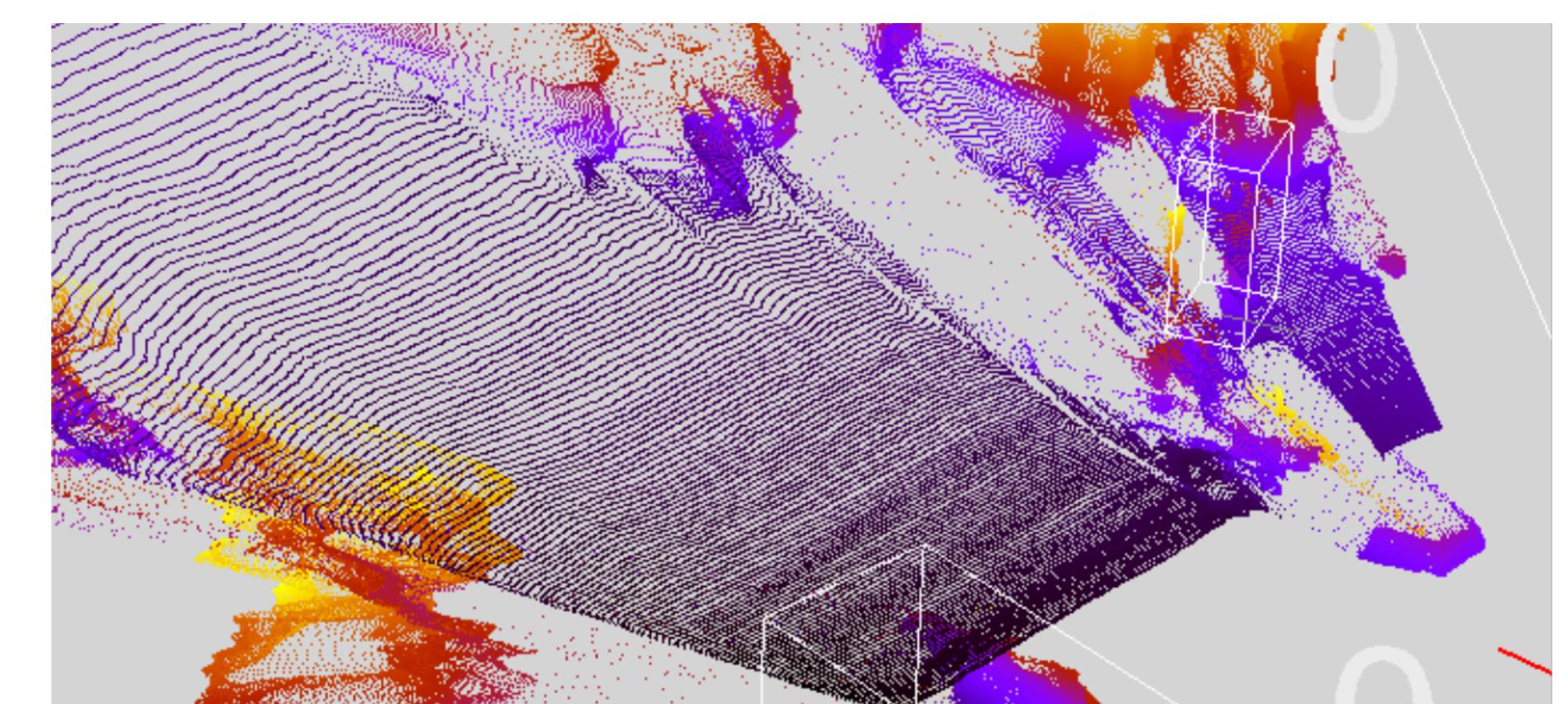
- 1) Left image and right image taken from KITTI dataset.



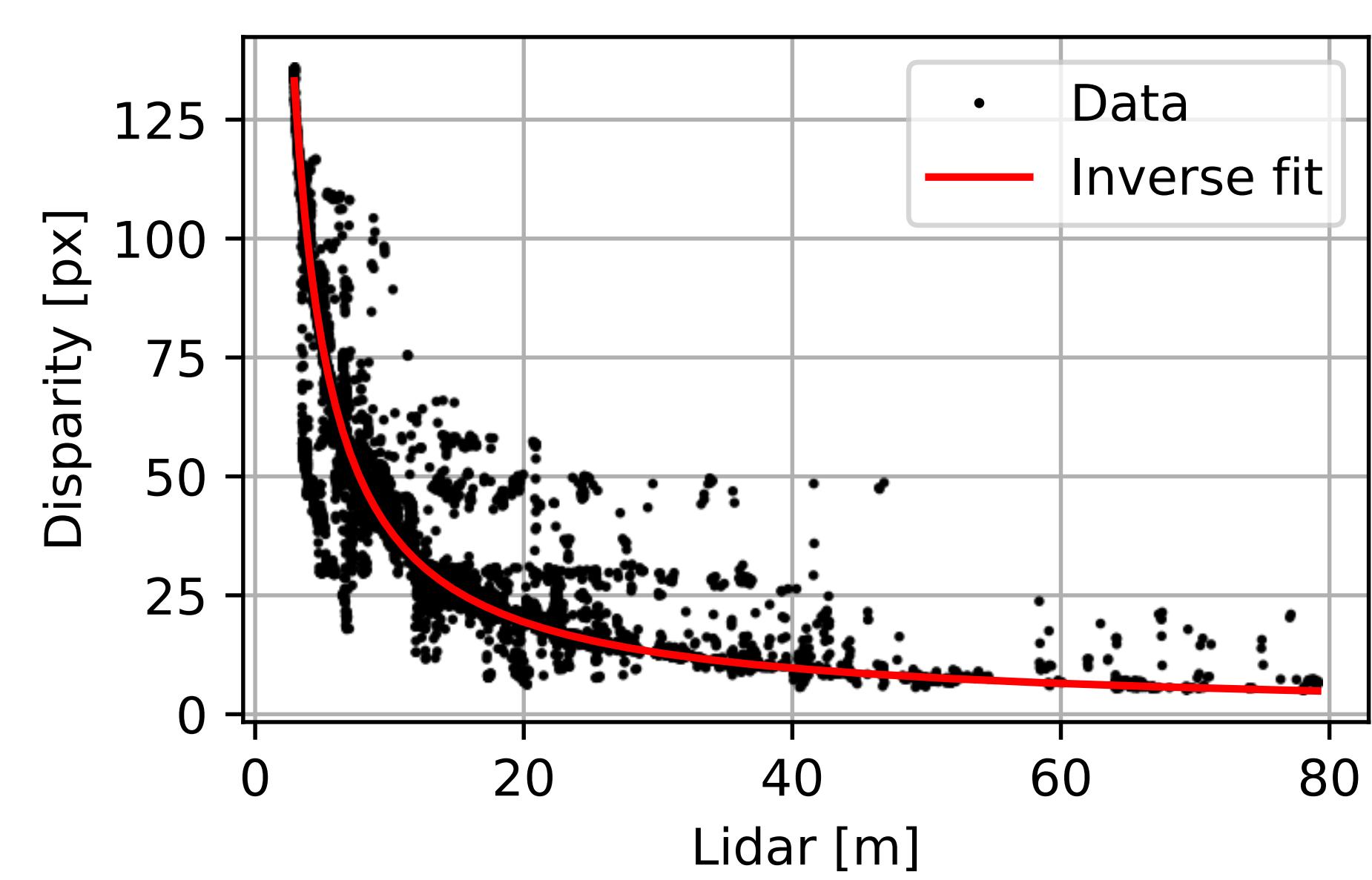
- 2) The color image pair are converted into a disparity map



- 3) The disparity map is reconstructed into a point cloud



- 4) The point cloud is used to find 3D objects in each scene.



There is an inverse relationship between stereo camera disparity and lidar distance.

A precision-recall curve comparing various neural networks on the KITTI dataset.

