Master Thesis:
Improved Normal Inference from Calibrated Illuminated RGBD Images

Grayscale or RGB image.

Depth Map (semi-dense)
and known calibration
→ point cloud or vertex map

Standard methods compute normals from point cloud using neighboring information in image space or use Shape from Shading

Semi-dense normal map

- Normals are only semi-dense (like point cloud). If mapped on mesh (dense) that‘s not good at all.
- Dependent on chosen neighbor size. If to small → noise sensitive. If to large → too smooth and not crispy.
- Errors may occur in regions with interreflections, where we have errors in the 3D measurement.

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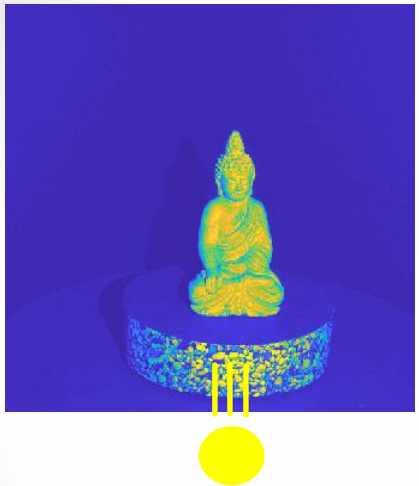
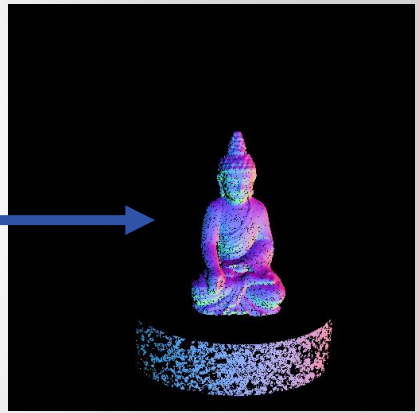


Image in different coloring to visualize the projector illumination.

Depth Map (semi-dense) and known calibration
→ point cloud or vertex map



Normal map that becomes hopefully better than this one, shown here…

- The texture image is already illuminated by strong directional light of a video projector, whose position is known.
- There exist theoretical relations between light direction, normal direction, basecolor albedo…
- Normals, basecolor, ... can be assumed to change coherently (often modelled by smoothness terms, should be modelled within the neural network).
- Using the given information this can guide us to better and dense normals (maybe also basecolor or albedo can be predicted jointly).

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Tasks:

- Create a synthetic data set with random scenes. (Unity project for rendering images and depth maps, normal maps and writing the calibration information is provided).
- Look for literature / related work. Test a classical method for comparison (especially geometry based)
- Create architecture to predict normals by neural networks.
- Add information on scene illumination to the network and improve the prediction by the known illumination direction.
- Compare to standard normal maps.
- Test the network, that has been trained and evaluated on synthetic data, on a real data set.