**Motivation & Related Works**

- Single photon avalanche detector (SPAD) based ToF Lidar systems suffer from high ambient light noise (SNR < 0.1)[1-6].

- Lindell et al. [3] has implemented CNN for SPAD denoising depth reconstruction task with intensity-SPAD sensor fusion.

- Fusion efficiency still needs to be improved: accuracy is worse than monocular depth estimations (with only 2D RGB image).

**Contributions**

- Different loss functions:
  - Wasserstein loss
  - Ordinal regression loss: linear / log-scale discretization.

- Different fusion structures:
  - 2D-3D fusion block, Deep-feature fusion, All-layers fusion…

**Results & Discussions**

- Ordinal loss with log-scale discretization (LD) improves performance by ~50%.

- Architecture experiment results:
  - Down-sampling worsens fusion quality
  - 2D intensity – 2D depth is fusion bottleneck.

**References**


**Future Works**

- Error distributions of SPAD denoising output and monocular depth estimator are complementary
- Merge the output of two networks can be beneficial
  - Confidence mask
  - Late fusion network…