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Surface Material Dataset for Robotics Applications (SMDRA): A Dataset with Friction Coefficient and RGB-D for Surface Segmentation

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Introduction

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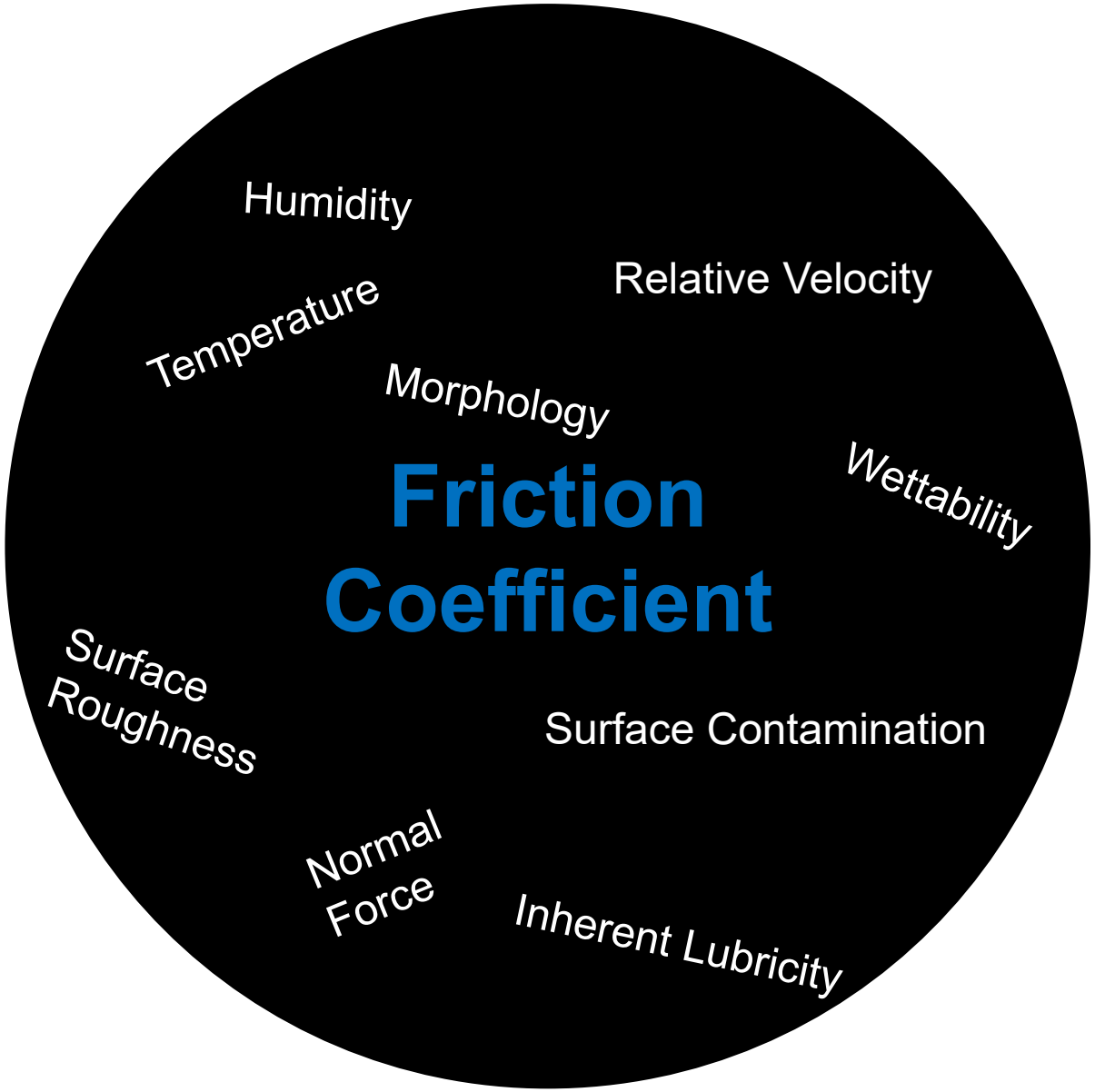

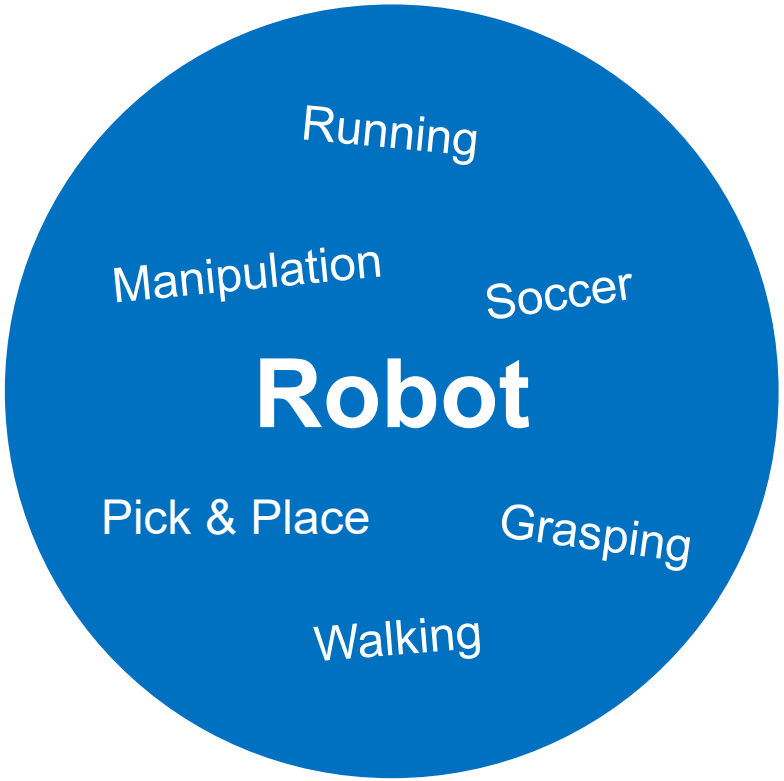

Method

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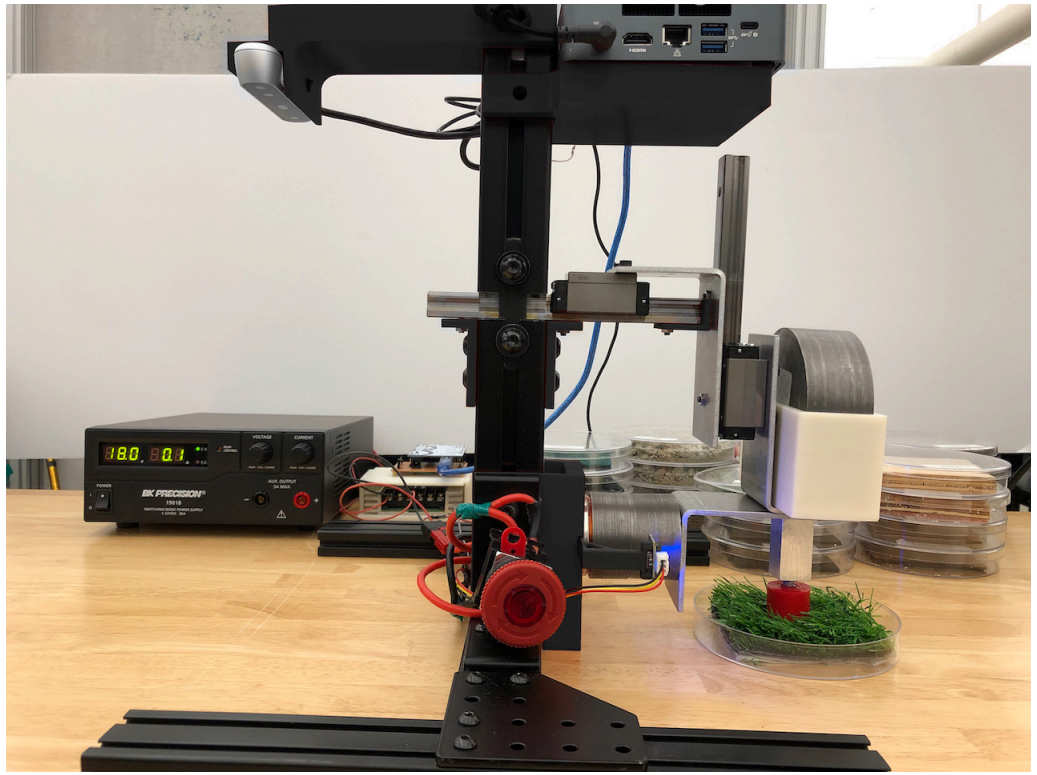

Fig 1. Data Collecting Device

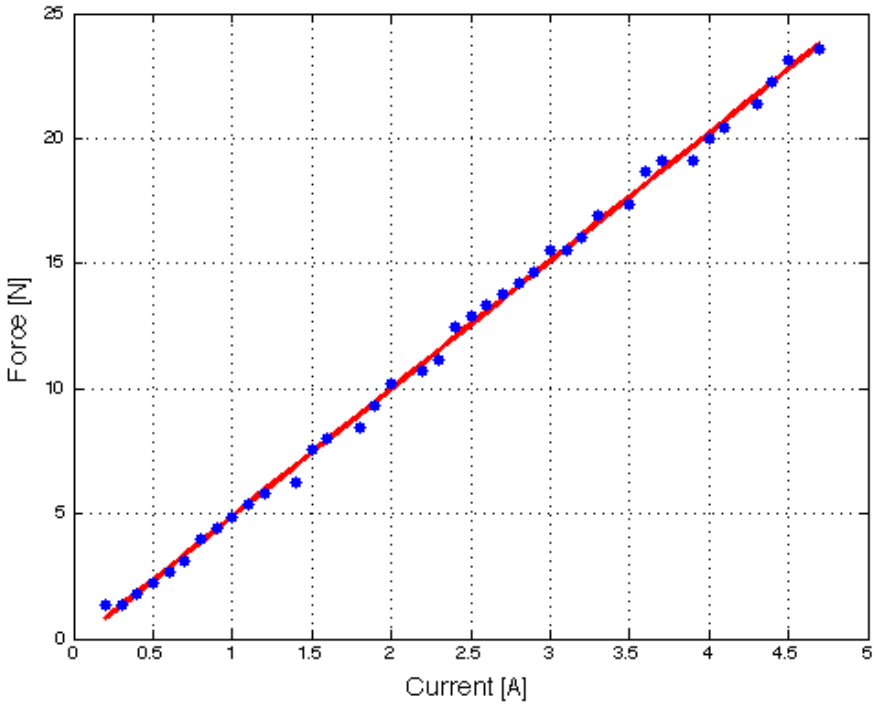

Fig 2. Recorded current [A] vs Force [N] of VCM

Method

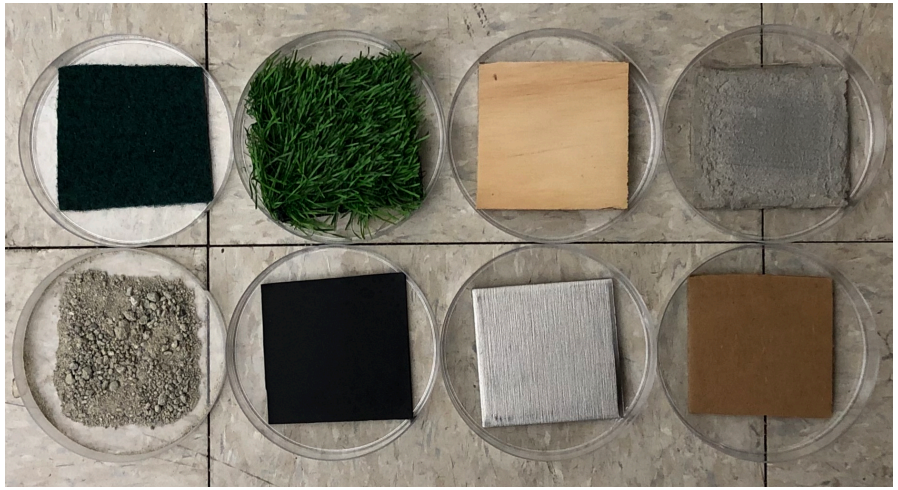

Fig 3. Measured Friction Coefficients

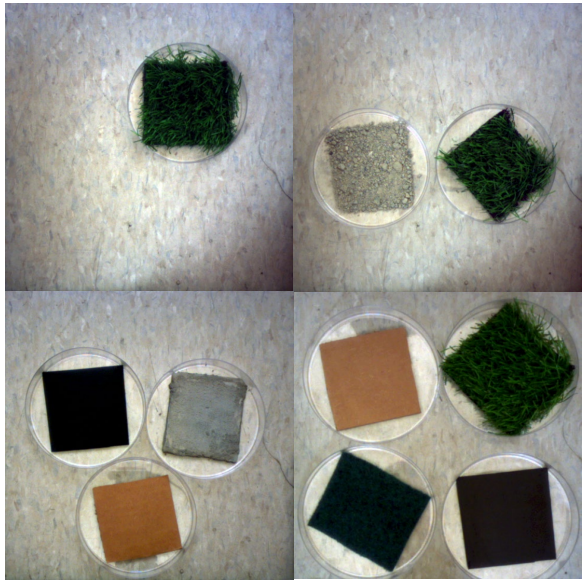

Fig 4. 4 Different Combinations of Materials

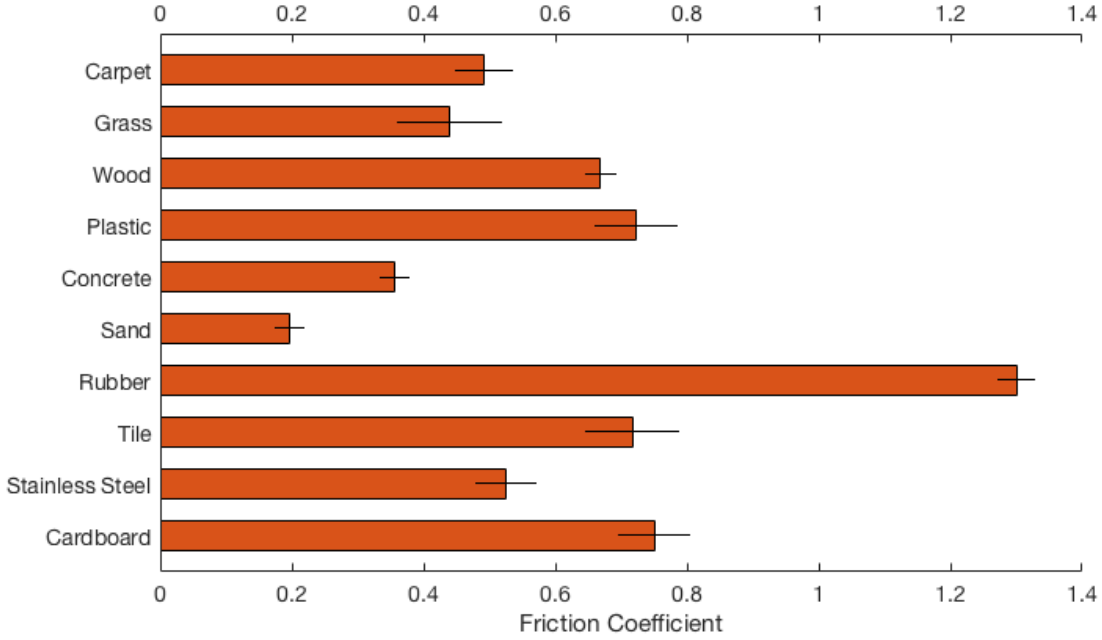

Fig 5. Measured Friction Coefficients

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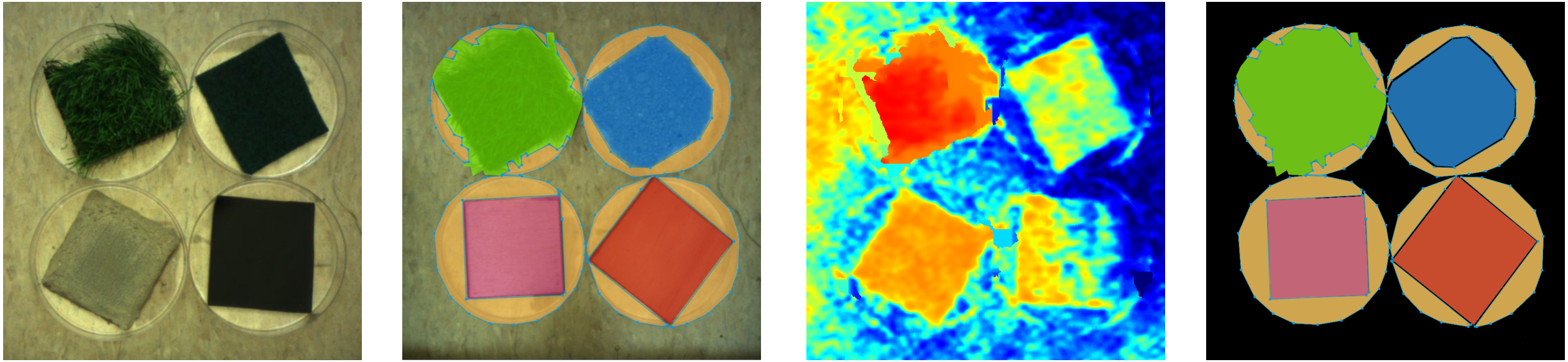

Fig 6. Examples of IR, Depth and Annotated Images

Result

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Architecture	FCN	U-Net
Input	RGB/RGBD	
Data Shape	512*512*3/512*512*4	
Batch Size	4	
Epochs	25	
Optimizer	Adam	
Activation Function	LReLU	

Table 1. Training Parameters

		Pixel Acc.	Mean Acc.	Mean IU
FCN	**RGB** **RGB-D**	0.95301 0.97288	0.90072 0.95477	0.79842 0.89749
U-Net	**RGB** **RGB-D**	0.95658 0.96286	0.86184 0.94738	0.75606 0.91287

Table 2. Training and Segmentation Results

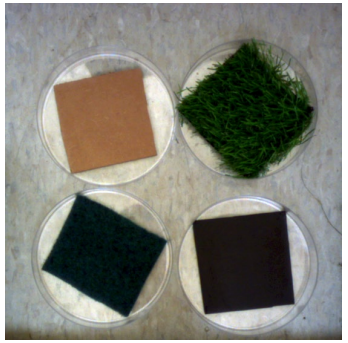
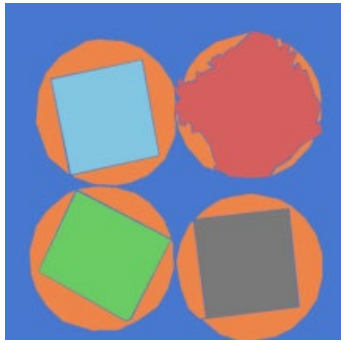
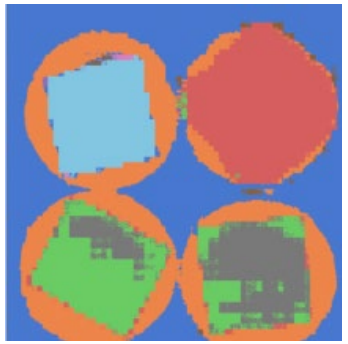
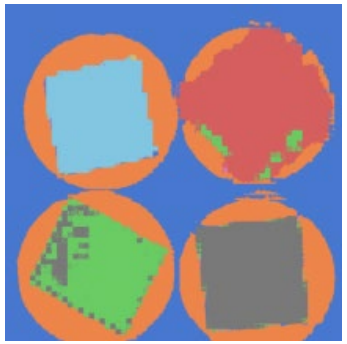
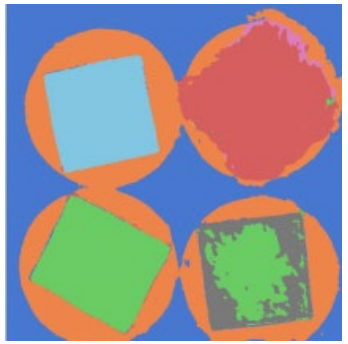
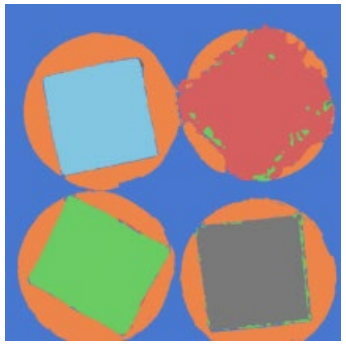
Raw Image/ Ground Truth			
FCN	RGB/RGBD		
U-Net	RGB/RGBD		

Table 3. Result Images of Cardboard, Grass, Carpet, Rubber, Plastic, and Tile

Conclusion

- Obtained reliable friction coefficient data using a newly developed device
- Successfully built a dataset consisting of RGB-D data and pixel-wise friction coefficient data
- Verified that two popular neural networks, FCN and U-Net, could be trained on the SMDRA

Future Works

- Expanding the dataset
- Developing a neural network architecture for friction coefficient estimation

Thank You!