Simulation of GelSight Tactile Sensors Wear and Tear

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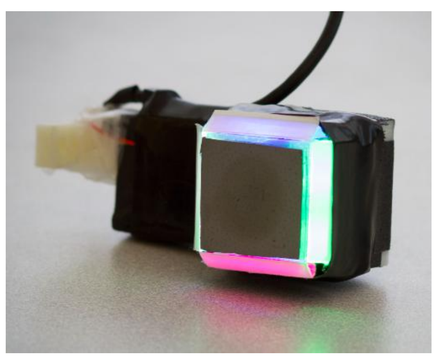


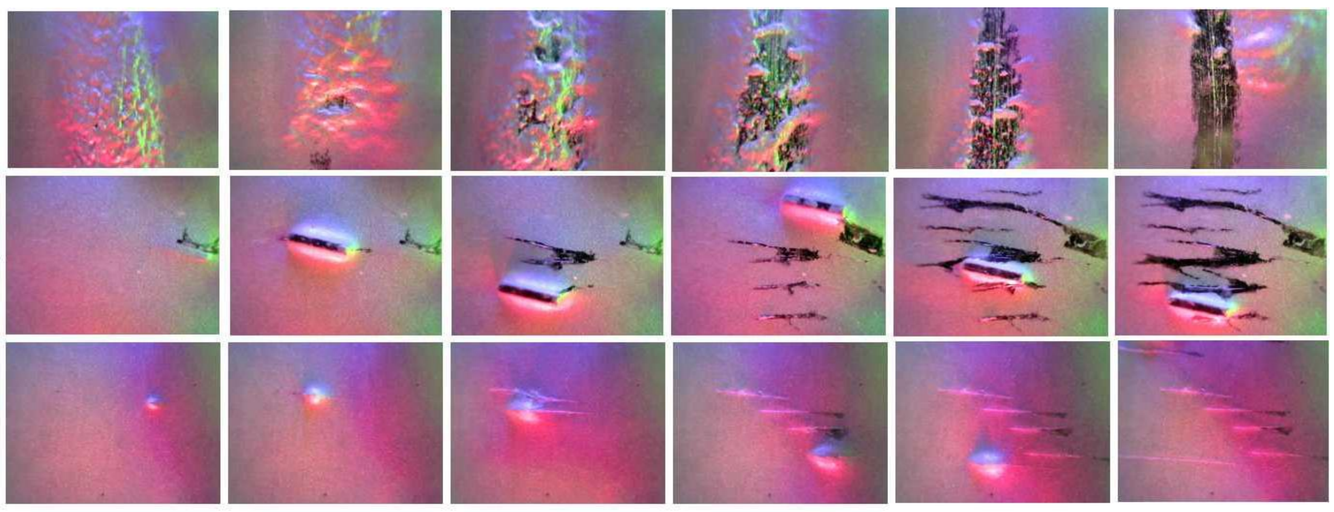
Abstract

Optical tactile sensors are prone to wear and tear.

However, existing simulation methods only consider undamaged sensing membranes.

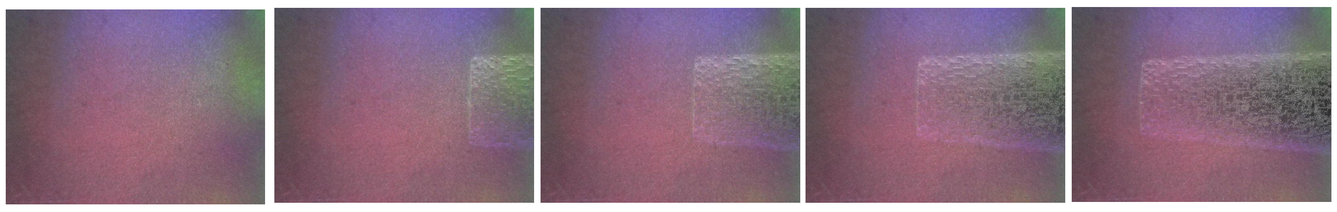
We extend our previous simulation method [1] to address these defects.

Real



Wearing and tearing of the real tactile sensor. First row shows the membrane being worn by sliding over sand paper. Second and third rows, tearing the membrane using different screwdriver bits.

Simulation



Synthethic membrane getting gradualy transparent over time due to the sliding against the synthethic sand paper. The artificial sandpaper is generated using a paramterizable randomly generated heightmap.

Limitations and Conclusions

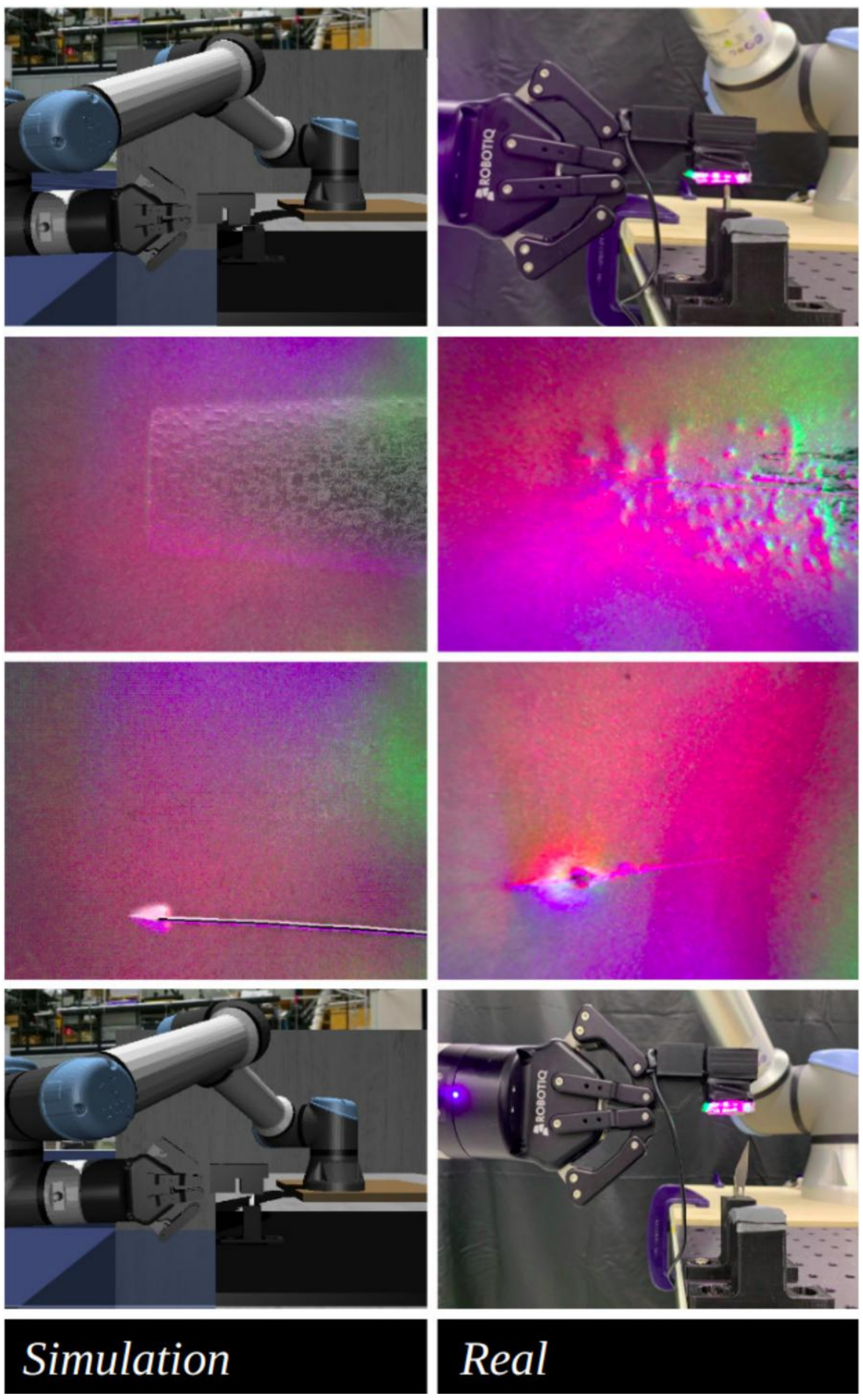
The quantitative evaluation of the methods is challenging due to the difficulty in aligning the real and synthetic wear and tear.

Future research should focus on addressing this issue, as well as leveraging this capability to learn sim2real policies that actively avoid sensor damage.

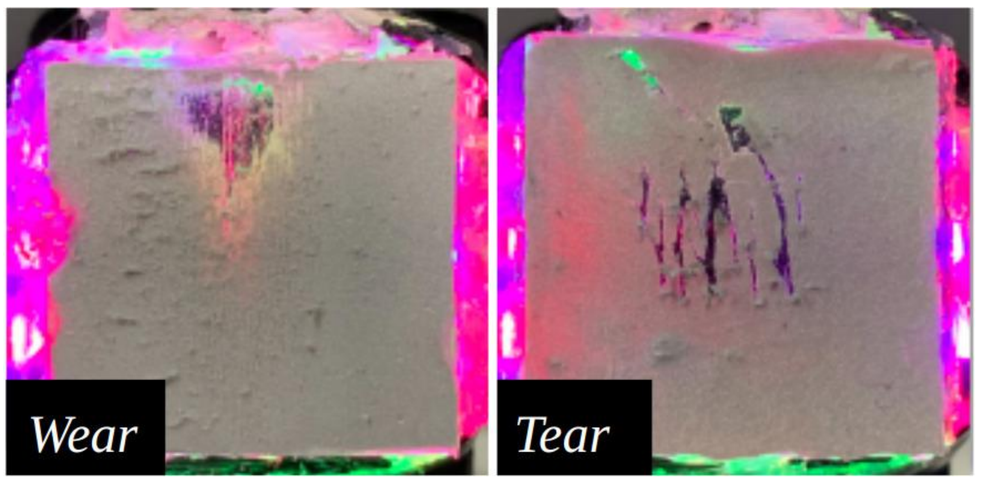
References

[1] D. F. Gomes and P. Paoletti and S. Luo "Generation of GelSight Tactile Images for Sim2Real Learning" RA-L 2021

[2] D. F. Gomes and P. Paoletti and S. Luo "Beyond flat gelsight sensors: Simulation of optical tactile sensors of complex morphologies for sim2real learning" RSS 2021



We investigate the simulating of the wear (resulting in transparent areas) and tear (punctures and cracking) of the membrane of optical tactile sensors.



Damaged membranes after collecting real tactile data. On the left, the worn membrane after sliding over sandpaper. On the right, the torn membrane after sliding over a scalpel.