The Robotic Soft Finger

Graeme O'Connell

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To improve on the existing robotic hand models that exist today, scientists based out of Osaka, Japan have decided to take a more organic approach to the problem, creating a robotic finger that is constructed physically similar to our own fingers. The model is soft (made of silicon), which allows better articulation with environmental objects, and a variety of randomly placed pressure sensors (strain gauges) and lateral motion sensors (PVDF films). The trick here is that the sensors are placed both near the surface of the "skin", and deeper, next to the "bone". The difference in these sensors can be extrapolated in conjunction with one another to give a more complete picture of what is happening when the finger touches an object. For instance, the shallow and deep strain gauges tell two completely different components of the interaction that is occurring between the finger and any object. The shallow sensor tells to what degree there is a static strain between the surface of the finger and the object, while the deeper gauges give the total force exerted on the object by the finger. Similarly, the two differently placed PVDF (polyvinylidene fluoride) films, when compared, will give the degree to which the surface of the finger is sticking to the object (call the stick-slip interaction). Pictured below is the finger model used by the experimenters:

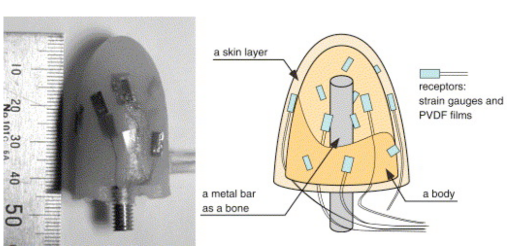

Figure 0: *Actual finger tip and artist's rendering of the components*

Tests performed by the group showed huge promise, as all three (shallow and deep PVDF films with shallow strain gauges) components were needed to distinguish between the tested materials, which were cork, paper, vinyl and two types of wood (not provided specifically which types). Using all the data, the final generated plot was a 3-D grid that had a clear distinction of all of the tested objects:

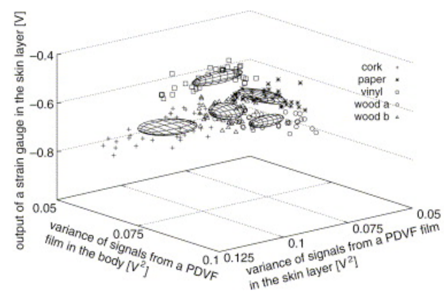

Figure 2: *Final plot of all tested materials*

These findings are important because there are increasingly many applications where the traditional hard-and-predictable robotic appendages are becoming too crude. The same students that performed this test continued the study with a visual component that was able to learn how to pick up a cup, and then use what it had learned to compensate for a sudden added weight of water without the element of human processing (interpolating the data).

References:

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