

# Tactile sensor

A [tactile sensor](#) is a [device](#) that measures information arising from physical interaction with its environment. Tactile sensors are generally modeled after the biological sense of cutaneous touch which is capable of detecting stimuli resulting from mechanical stimulation, temperature, and pain (although pain sensing is not common in artificial tactile sensors). Tactile sensors are used in [robotics](#), computer hardware and security systems. A common application of tactile sensors is in touchscreen devices on mobile phones and computing.

Tactile sensors may be of different types including piezoresistive, [piezoelectric](#), capacitive and elastoresistive sensors.

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Reliable intraoperative [delineation](#) of [tumor](#) from healthy [brain tissue](#) is essentially based on the neurosurgeon's visual aspect and [tactile](#) impression of the considered [tissue](#), which is due to inherent low brain consistency contrast-a challenging task. Development of an intelligent [artificial](#) intraoperative tactile perception will be a relevant task to improve the safety during surgery, especially when-as for neuroendoscopy-tactile perception will be damped or-as for surgical robotic applications-will not be a priori existent.

Stroop et al. from the Department of Neurosurgery, Academic [Hospital Cologne-Merheim](#), Department of Engineering Technology (INDI), Vrije Universiteit Brussel, Brussels, Belgium, presented the enhancements and the evaluation of a tactile sensor based on the use of a [piezoelectric](#) tactile sensor.

A robotic-driven piezoelectric bimorph sensor was excited using multisine to obtain the frequency response function of the contact between the sensor and fresh ex vivo porcine tissue probes. Based on load-depth, relaxation and creep response tests, viscoelastic parameters E1 and E2 for the elastic moduli and  $\eta$  for the viscosity coefficient have been obtained allowing tissue classification. Data analysis was performed by a multivariate cluster algorithm.

Cluster algorithm assigned five clusters for the assignment of white matter, basal ganglia and thalamus probes. Basal ganglia and white matter have been assigned to a common cluster, revealing a less discriminatory power for these tissue types, whereas thalamus was exclusively delineated; gray matter could even be separated in subclusters.

Bimorph-based, multisine-excited tactile sensors reveal a high sensitivity in ex vivo tissue-type differentiation. Although, the sensor principle has to be further evaluated, these data are promising <sup>1)</sup>.

<sup>1)</sup>

Stroop R, Nakamura M, Schoukens J, Oliva Uribe D. [Tactile sensor](#)-based real-time [clustering](#) for [tissue differentiation](#). Int J Comput Assist Radiol Surg. 2018 Oct 6. doi: 10.1007/s11548-018-1869-5. [Epub ahead of print] PubMed PMID: 30293172.

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