# Sensorized surgical device and method of operation of this device

## KEYWORDS

- ❑ CANCER
- ❑ SURGICAL DEVICE
- ❑ TISSUE CHARACTERIZATIO N
- ❑ AI
- ❑ ELECTRONIC SENSOR

## AREA

- ❑ BIOMEDICAL


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**Patent Type**
Patent for invention.

**Co-Ownership**
Sapienza University of Rome 100%

**Inventors**
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**Industrial & Commercial Reference**
The surgical device can be applied in the health care sector.

**Time to Market**
The functional and technical requirements of the device and of the individual sub-blocks have been defined, presently the invention has not yet been created/tested/prototyped. TRL 2.

**Availability**
Cession, Licensing, Research, Development, Experimentation, Collaboration, Start-up and Spin-off.

Fig. 1 Photo of a standard surgical forceps

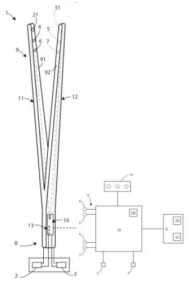

Fig. 2 Drawing of the sensorized surgical forceps (left) and processing unit detail (right)

Fig. 3 Team of surgeons at work in the operating room


**Abstract**
The proposed device and methodology are capable of diagnosing in real time the presence or absence of cancerous tissue on the piece under examination during surgery, signaling the outcome through a pair of differently colored LEDs. The device is equipped with multiple sensors for collecting data in real time, and with an algorithm, implemented on hardware interfaced with the instrument itself, which allows the possible cancerous nature of the tissue under analysis to be quickly and highly probable identified by means of electrical impedance measurement, optical spectrometry, and analysis of membrane potential and heat release.

# Sensorized surgical device and method of operation of this device

**Technical Description**

The device consists of a surgical forceps that can be used both in minimally invasive and traditional surgery. Sensors are applied to the device to collect data in real time in addition to a recognition algorithm, implemented on hardware interfaced with the device itself. The activity of these sensors consists in detecting the electrical impedance, the optical signals, the membrane potential and the heat release of the tissue contained between the arms of the forceps, so as to allow the identification quickly and with high probability of the its possible cancerous nature. The nature (cancerous or not) is indicated by means of a LED, so it becomes immediately visible to the surgeon.

**Technologies & Advantages**

Intraoperative extemporaneous examination is an anatomic-pathologic diagnosis performed during surgery on a fragment of the suspected neoplastic lesion, depending on the result of which the surgery itself can be conducted conservatively or demolitionally. It consists of numerous complex procedures to be performed in a predetermined sequence that, in addition to a considerable logistical effort, also require highly skilled personnel and associated costs. The competitive advantage of the invention is that the device allows the surgeon to classify in real time the tissue type (cancerous or noncancerous) by a sensor's system

**Applications**

The developed device may find use in various medical areas. In particular, the device may find application in the med-tech sector. In fact, the proposed device and methodology are capable to predict in real time the presence or absence of cancerous tissue on the piece under examination or during surgery, providing an immediate response, and giving the possibility to perform the measurement on multiple contiguous pieces without having to perform multiple biopsies. this significantly reduces the costs deriving from the use of qualified personnel and hospital spaces.

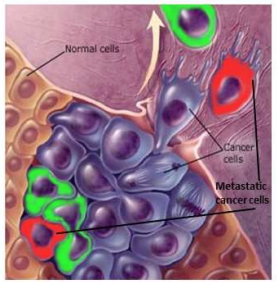


Fig. 4 Tissue in which healthy and cancerous cells are highlighted

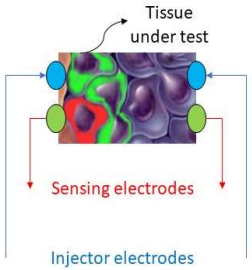


Fig. 5 Setup for electrical impedance measurement

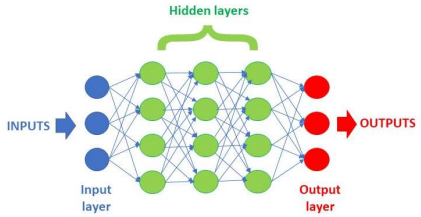


Fig. 6 Architecture of a Convolutional Neural Network

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