

Physical nature of different biosignals

Definition

Biological signal is a summarizing term for all kinds of signals that can be (continually) measured and monitored from biological beings. It shows chemical or physical quantities that characterize the property or state of human biological condition. The term biosignal is often used to mean bio-electrical signal but in fact, biosignal refers to both electrical* and non-electrical signals. Biosignal can be defined as a description of a physiological phenomenon.

*The term electrical Biosignals refers to changes in electric currents produced by the sum of electrical potential differences across a specialized tissue, organ or cell system.

Describing biosignals

- **Continuous signals** are described by a continuous function $s(t)$ which will show information at any time.
*Most biomedical signals are continuous
- **Discrete signals** are described by a sequence $s(m)$ which will show information exactly at a particular time.
- **Deterministic signals** are signals which can be determined and described exactly using mathematics or graphics. Real world biosignals are never deterministic. Periodic signals belong to this group and are expressed by $s(t) = s(t+nT)$ n is integer and T is period. Blood pressure could be characterized as a complex periodic signal.
- **Stochastic signals** cannot be expressed exactly but only in terms of probabilities. *Stationary stochastic processes* will not change in time. The expectations of such a process is time independent. Most of them are non stationary. An example would be EEG (Electroencephalography)

Classifications

Since there are many Biosignals it is very hard to find a unique way of classifying them.

Classification by existence

- *Permanent biosignals*
They can exist without an artificial trigger and are available at any time. The source for those Biosignals is already inside the body.
- *Induced biosignals* are artificially triggered or induced and last only during the time of excitation.

Classification by dynamic nature

- A *static* biosignal carries information in its steady state level which may exhibit relatively slow changes over time.
- *Dynamic* biosignals yield extensive changes in the time domain, with dynamic processes conveying the physiological information of interest.

Classification by origin

- *Magnetic biosignals*
These signals include motion and displacement signals, pressure and tension and flow signals, and others.
- *Optic biosignals*
are the result of optical functions of the biologic system, occurring naturally or induced by the measurement (Blood oxygenation)
- *Acoustic biosignals*
Many physiological phenomena create noise like the flow of blood in the heart or through blood vessels also the flow of air through the airways creates acoustic sounds.
- *Chemical biosignals*
reflect chemical composition and its temporal changes in body solids, liquids, and gases. Examples are measuring the concentration of various ions and vicinity of a cell by means of specific ion electrodes
- *Thermal Biosignals*
Temperature measurement shows physical and biochemical processes proceeding in organism. (Heat loss, heat

absorption)

Links

Related articles

External links

Bibliography

KANUISAS, E. *Biomedical Signals and Sensors I* [online] . XVII edition. 2012. Chapter 1. Available from <<http://www.springer.com/978-3-642-24842-9>>. ISBN 978-3-642-24842-9.

Incomplete citation of web. . *Biosignals; generation, processing, analysis* [online]. [cit. 2012-12-10]. <<http://ulb.upol.cz/lectures/vaa11/biosignals.pdf>>.

Incomplete citation of web. . *Introduction to Biosignal Detection* [online]. [cit. 2012-12-10]. <<http://i-health.u-aizu.ac.jp/IBSD/1.%20Introduction.pdf>>.