Technology and Medicine: prediction of surgical site infection in clean surgeries using artificial neural networks

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Background

This research represents an experiment on surgical site infection (SSI) in patients **undergoing clean surgery procedures** in hospitals in Belo Horizonte,

Period: between July 2016 and June 2018.

Objectives:
1 - Statistically evaluate SSI incidences
2 - Enable a study of the prediction power of SSI of pattern recognition algorithms based in Multilayer Perceptron (MLP).

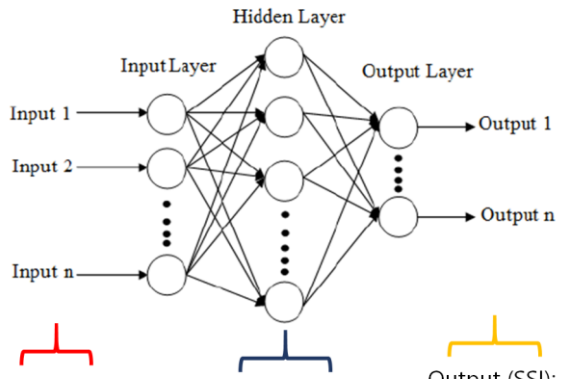
Methods

Data were collected on SSI in **six hospitals.**

The **Hospital Infection Control Committees (CCIH)** of the hospitals involved collected all data used in the analysis during their routine SSI surveillance procedures and sent the information to the **Nosocomial Infection Study Project (NOIS)** through the **Software Automated Hospital Infection Control System (SACIH)** to collect data from a sample of hospitals.

Three procedures were performed:
1 - A treatment of the database collected for use of intact samples;
2 - A statistical analysis on the profile of the hospitals collected
3 - An assessment of the predictive power of **five types of MLP** (Backpropagation Standard, Momentum, Resilient Propagation, Weight Decay, and Quick Propagation) for SSI prediction. They were compared by measuring AUC (Area Under the Curve - ranging from 0 to 1) presented for each of the configurations.

MLP

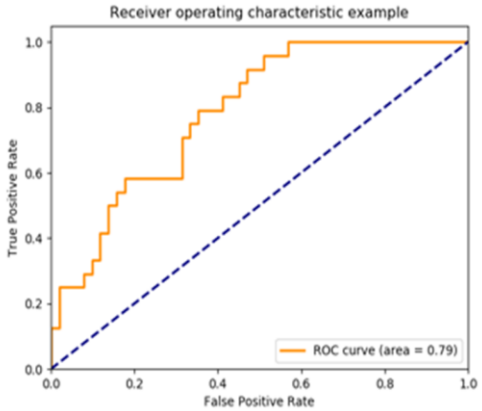


Data Collected (each input n is a variable like age, gender ...)

Tests with 3,5, 7 and 10 neurons

Output (SSI):
0 – No
1 – Yes

AUC



Results

From **45,990** records, **12,811** were able for analysis.
The statistical analysis results were:

- The average age was **49 years old** (predominantly between **30 and 50**);
- The surgeries had an average time of **134.13 minutes;**
- The average hospital stay is **4 days** (from 0 to 200 days);
- The death rate **reached 1%** and the **SSI 1.49%.**

A maximum prediction power of **0.742** was found.

Conclusion

There was a loss of **60% of the database samples** due to the presence of noise. However, it was possible to have a relevant sample to assess the profile of these six hospitals in Belo Horizonte.

The predictive process, presented some configurations with results that **reached 0.742**, what promises the use of the structure for the monitoring of automated SSI for patients submitted to surgeries considered clean.

To optimize data collection and enable other hospitals to use the SSI prediction tool (available in www.sacihweb.com), two mobile application were developed:
1 - for monitoring the patient in the hospital
2 - for monitoring after hospital discharge.

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Grupo NOIS Nosocomial Infection Study