Risk Prediction for Surgical Site Infection in Patients Subject to Knee Arthroplasty Surgery

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Background

This research represents an experiment on surgical site infection (SSI) in patients undergoing knee arthroplasty surgery procedures in hospitals in Belo Horizonte.

2016

Period: between July 2016 and June 2018.

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).
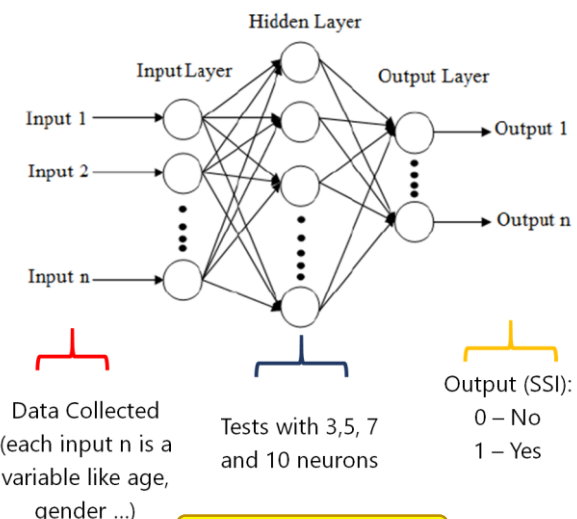
Methods

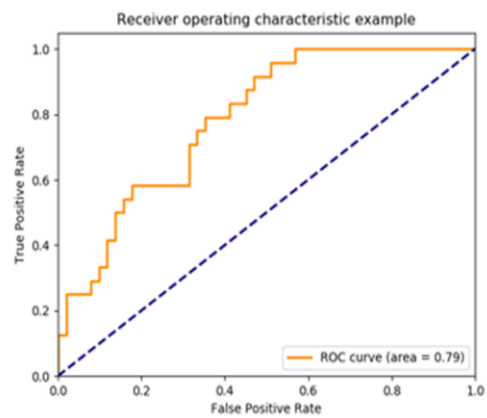Data were collected on SSI in **five hospitals.**

The **Hospital Infection Control Committees (CCIH)** of the hospitals group 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 database treatment for use of intact samples;
2 - A profile statistical analysis of the hospitals group,
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

Hidden Layer

Input Layer — Output Layer

Input 1 — Output 1
Input 2 — Output n
Input n

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

Receiver operating characteristic example

ROC curve (area = 0.79)

Results

From the **1438** data collected, **390** records were usable, and:
- The average age of the patients who underwent this surgical procedure was **70** (ranging from **29** to **92**);
- Average surgery time was **171 minutes** (between **50** and **480**);
- **47%** presented a hospital contamination;
- **1%** SSI and no deaths;

During the MLP experiments, due to the low number of SSI cases, the prediction rate for this specific surgery was **0.5**.

Conclusion

Despite the large noise index of the database, it was possible to have a relevant sampling to evaluate the profile of hospitals in Belo Horizonte.

However, for the predictive process, despite some results are equal to 0.5, the database demands more samples of SSI cases, as only 1% of positive samples generated an unbalance of the database.

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