Glaucoma Prognostication Platform

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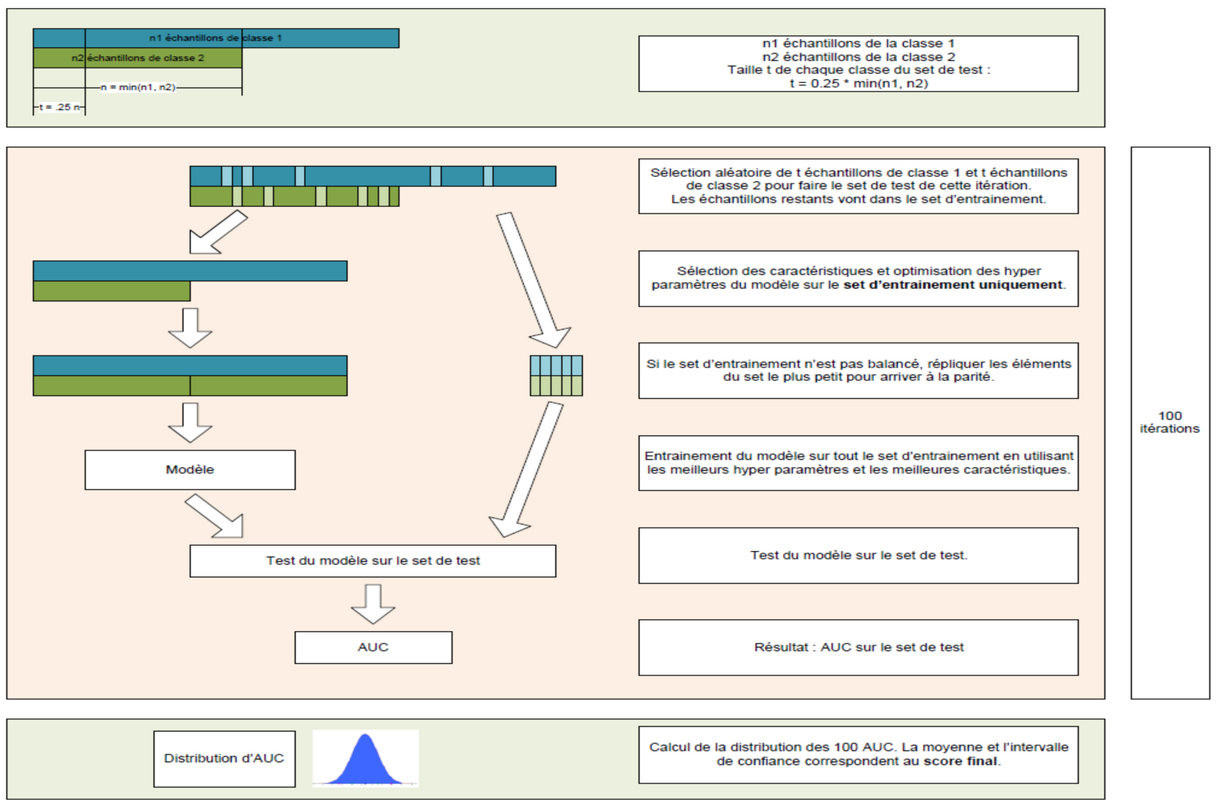
Rationale

More than 80 million people worldwide suffer from **glaucoma**, an asymptomatic and irreversible disease of the optic nerve leading to blindness unless intra-ocular pressure (IOP) is controlled. IOP is the only controllable risk factor to stabilize patients, and various therapeutic options exist to reduce IOP. IOP follows, however, individual nycthemeral patterns and cannot be effectively monitored with current devices leading to therapeutic failure and progression visual function loss amongst about one in three glaucoma patients. SENSIMED AG has developed **Triggerfish**, a wearable non-invasive solution that captures spontaneous dimensional changes at the corneoscleral area. The purpose of the **Glaucoma Prognostication Platform** is to provide a **machine learning platform** for 24h profiles of ocular dimensional changes to predict the **progression of glaucoma**.

Methods and tools developed

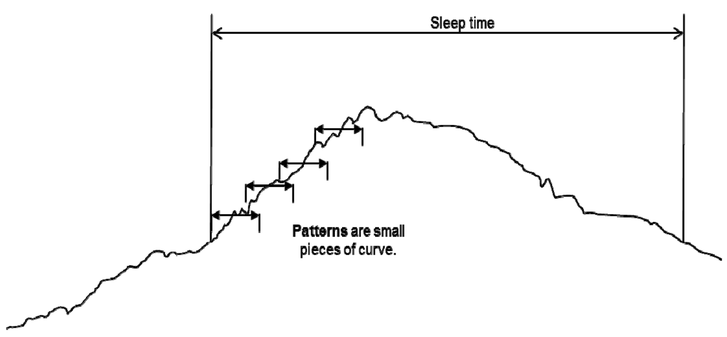
- A standard operating procedure for creating set of profiles without bias.
- Consistent set of profiles without bias.
- Algorithms to **clean** up profiles.
- A baseline system.
- Methods for **feature selection**.
- Optimized input features set.
- New **clustering** of glaucoma varieties.
- **Leading** parameters in a profile.
- Progression glaucoma models.
- **Classification** models for different states of glaucoma disease and progression.

Baseline system

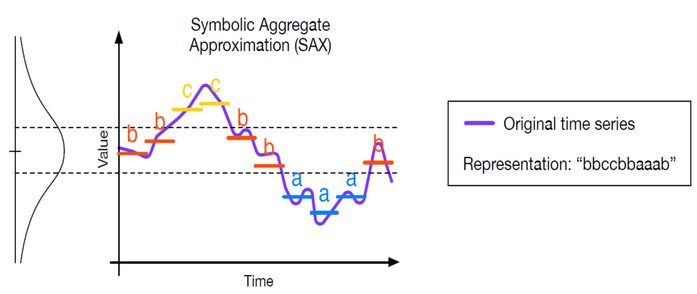


Machine Learning models and algorithms

Dynamic Time Warping, clustering methods (**K-Means, Agglomerative, Birch, Gaussian Mixture Models**), **Symbolic Aggregate Approximation,** feature selection based on **Random Forest** and **Gaussian Mixture Models**, classification methods (**Random Forest, Support Vector Machine)**, regression (**linear model**, **K-Nearest Neighbors**, **Kernel Ridge Regression**, **Support Vector Regression**).



The figure shows a schematic example of Triggerfish curve (–). We consider pieces of curves as potential patterns (↔). All the pieces have the same length and may overlap adjacent pieces. The length of the pieces and the length of overlapping are two tuning parameters when searching for patterns in curves.



Symbolic Aggregate Approximation (SAX) converts time series into discrete sequence of symbols. The original time series (–) is represented by a sequence of symbols "a" (–), "b" (–), and "c" (–). The initial time series is divided into equally spaced segments, the mean value of each segment is computed, and it is discretized into a set of symbols form a given alphabet. In our example the alphabet (a, b, c) has length equal to three and the resulting representation is "bbccbbaaab".

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