



**Data
Science**

Information fusion in data analysis

Data Fusion - Project

Alberto Cardoso, Jorge Henriques

alberto@dei.uc.pt, jh@dei.uc.pt



Departamento de Engenharia Informática
Faculdade de Ciências e Tecnologia
UNIVERSIDADE DE COIMBRA

■ Goal

- To develop a risk model, applicable to artery coronary syndrome (ACS) patients that have been admitted to the emergency unit with an episode of myocardial infarction (MI)
- The model should be able to fuse different sources of information in order to predict if a new event will occur in the next 30 days.



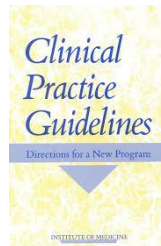
► Risk assessment of a new event



Age
Gender
Historical – risk factors

Heart rate
Blood pressure
Electrocardiogram

KILIIP class
Blood test



New event ?

$\{ 0, 1 \} = \{ \text{No}, \text{Yes} \}$

► Risk assessment of a new event : INPUTS



• 1| Historical

- **GD** | Gender | { female, male } = { 0, 1 }
- **AG** | Age | [33 .. 91]
- **RF** | Risk Factors | { noRisk, risk } = { 0, 1 }
 - RF - Related with the clinical history of the patient
 - Family, past events, ...





► Risk assessment of a new event : INPUTS

• 2| Measurements

- **BP** | Systolic blood pressure | [60 .. 221]
- **HR** | Heart rate | [40 .. 153]
- **ST** | ST elevation | {0, 1}

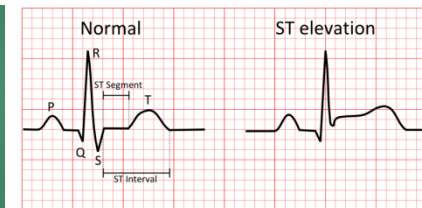
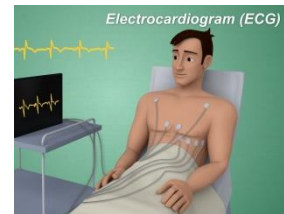
• BP device

- Measurement of **BP**
- Measurement of **HR**



• Electrocardiogram - ECG

- **ST** elevation is the most important parameter
- Measurement of **HR**



HR measured with ECG is more accurate than the one measured with BP device
It can be assumed that the deviation from the true value:

- $\sigma(\text{HRBP})=2$ - $\sigma(\text{HRECG})=0.5$

► Risk assessment of a new event : INPUTS



- **3| Blood test**

- **CT** | Creatinine | [0.6 .. 11.5]





► Risk assessment of a new event : INPUTS

• 4 | Clinical evidence

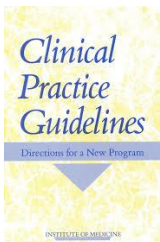


- **KL – Killip class** - the result of the physical examination | {1, 2, 3}
 - 1 - No signs
 - 2 - Mild to moderate signs
 - 3 - Pulmonary edema (Severe)
 - ~~4 – Cardiogenic shock (Severe)~~ % not considered in this dataset

• Clinical guidelines

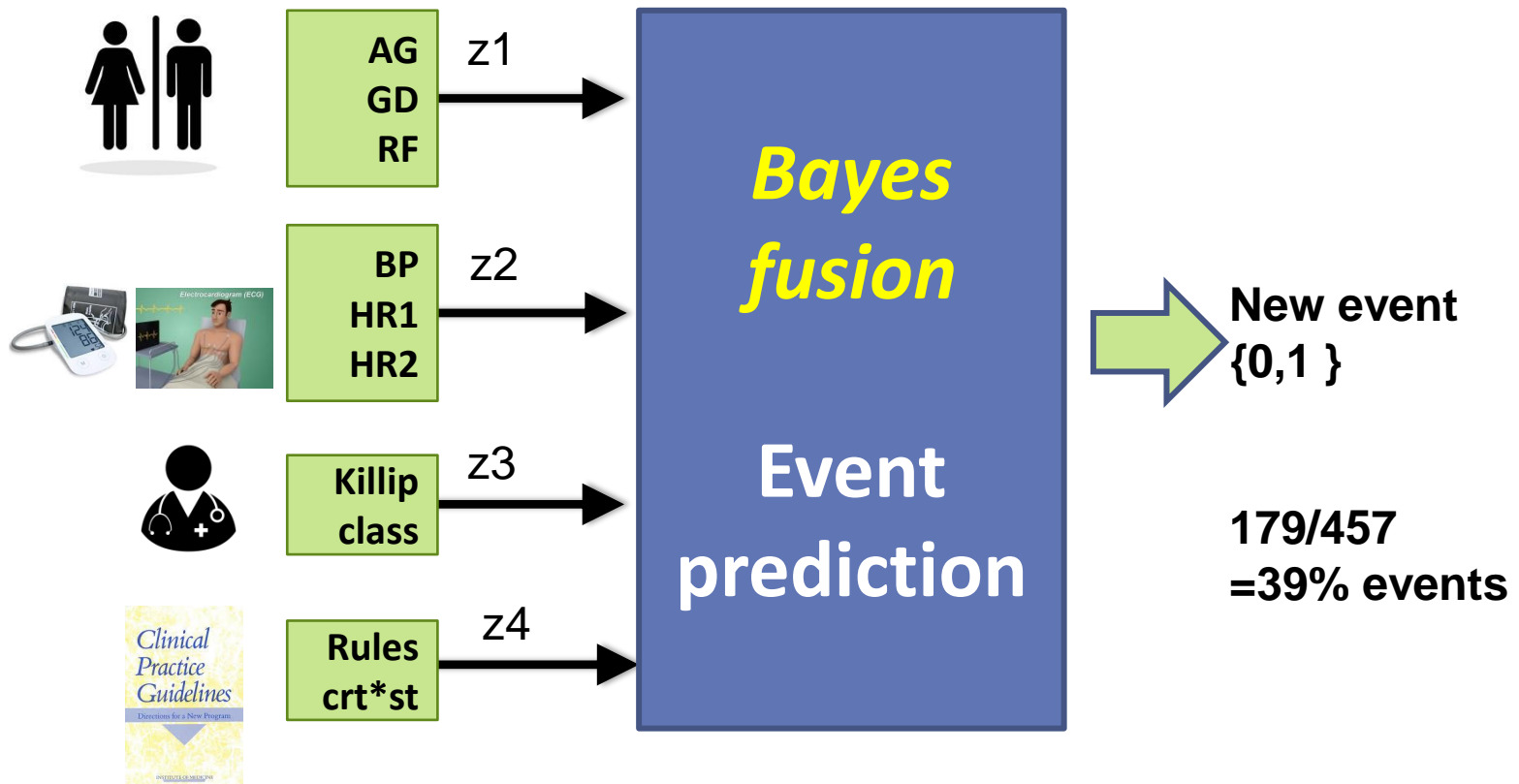
- Creatinine value greater than 1.2 for patients with ST segment elevation is a sign of risk
- Thus

If $CT \geq 1.2$ AND $ST=1$ risk=1



Information fusion

- Historical, measurements, clinical knowledge, guidelines





DATASET

Col1	Col2	Col3	Col4	Col5	Col6	Col7	Col8	Col9	Col10
Gender	Age	Risk Factors	Systolic Blood Pressure	Heart rate (SBP)	ST segment (ECG)	Heart rate (ECG)	Creatinine	Killip class	EVENT
{0,1}		{0,1}			{0,1}			{1,2,3}	{0,1}

- Discrete variables (3)**

- Gender, riskFactors, STsegment

- Categorical variables (1)**

- killipClass {1,2,3}



- Continuous variables (3 + 1+1)**

- Age, systolicBloodPressure, Creatinine
- HR1, HR2 – two sensors are measuring the same variable !

■ Metrics / Performance

- Sensitivity
- Specificity

■ Evaluation

- **Code**
- **Report** 
- **Defense** 
 - If justified a defense may occur

- **Date**
 - ??