

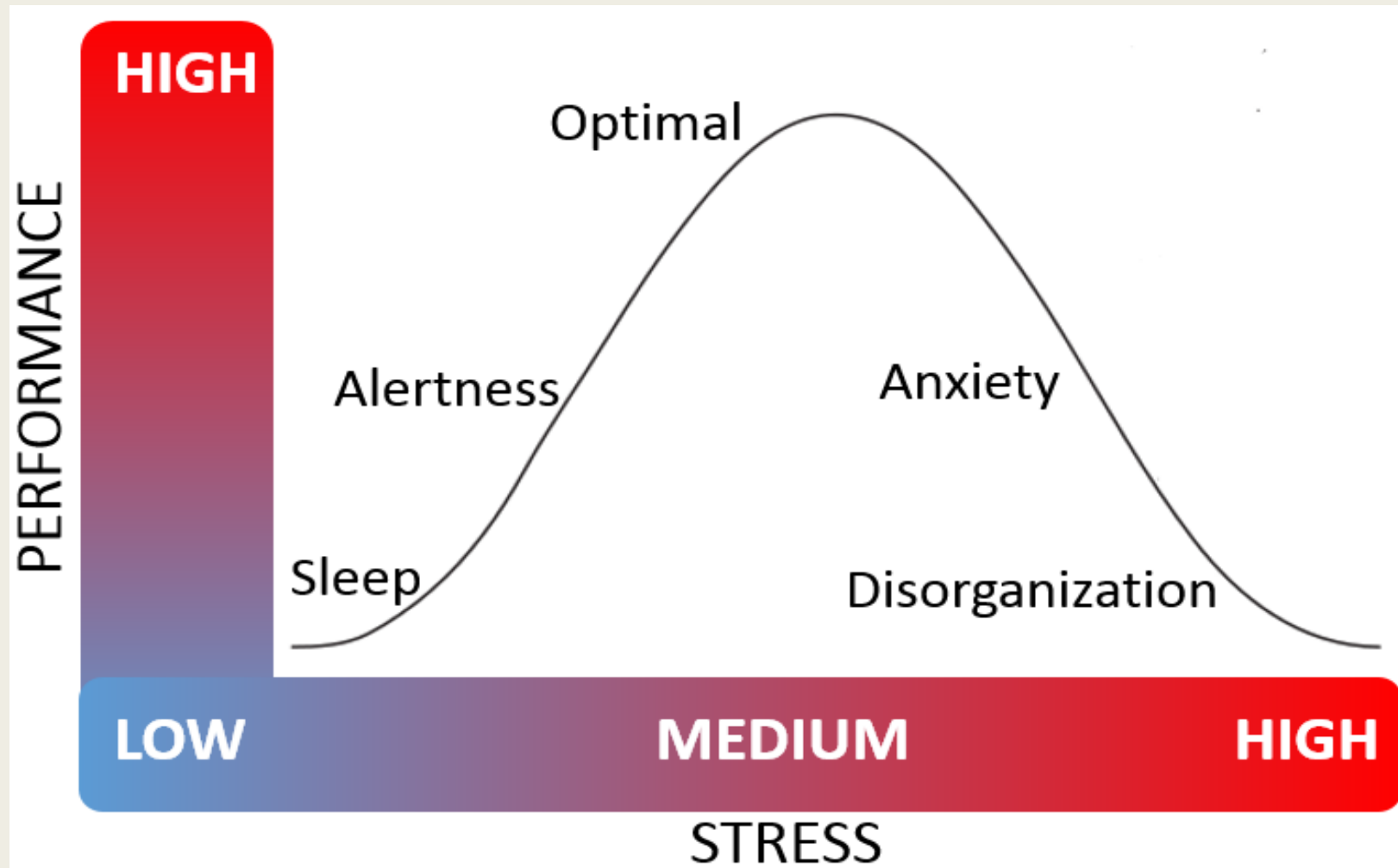
# CONTINUOUS STRESS DETECTION USING A WRIST DEVICE -IN LABORATORY AND REAL LIFE-

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# Motivation



# Motivation

## **Chronical stress:**

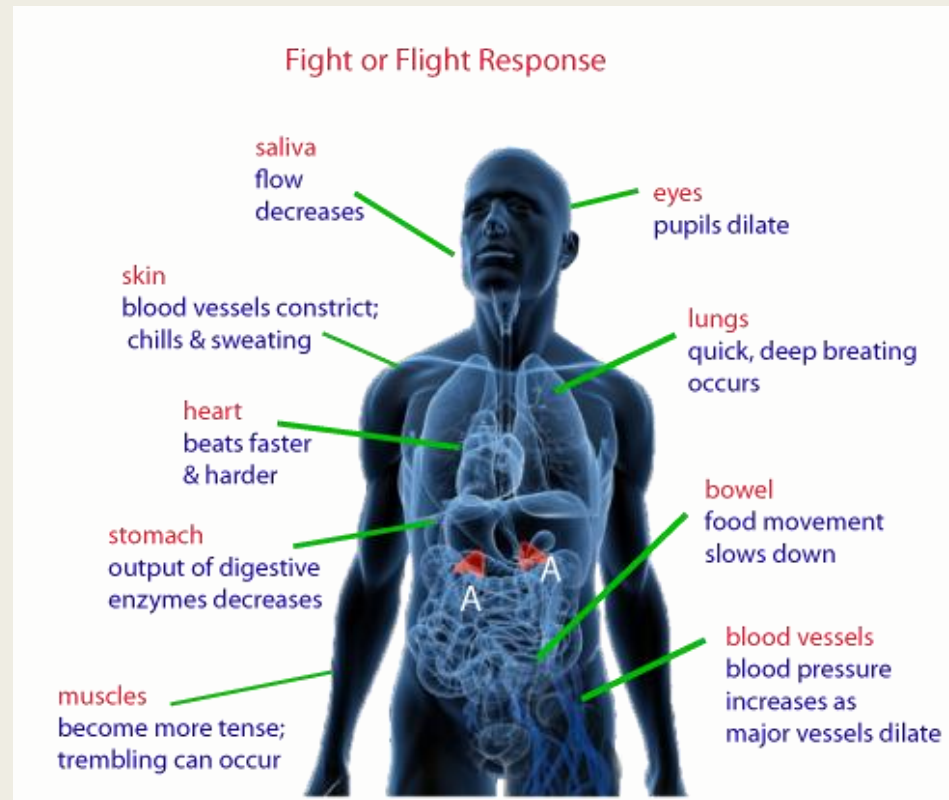
- raised blood pressure
- bad sleep
- infections
- decreased performance
- slower recovery

**EU, work-related stress costs €20 billion a year.**

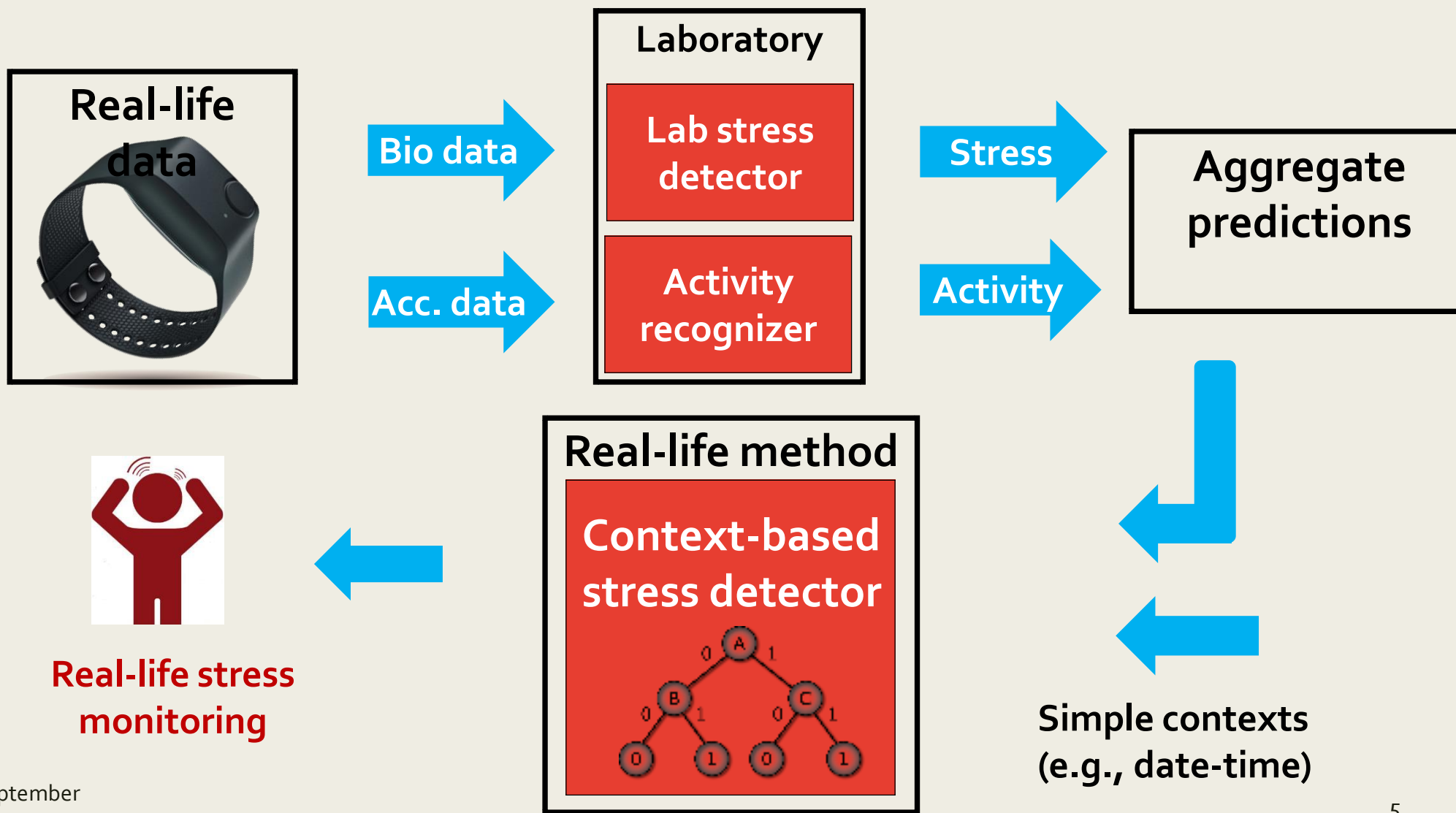
STRESS

# Definition

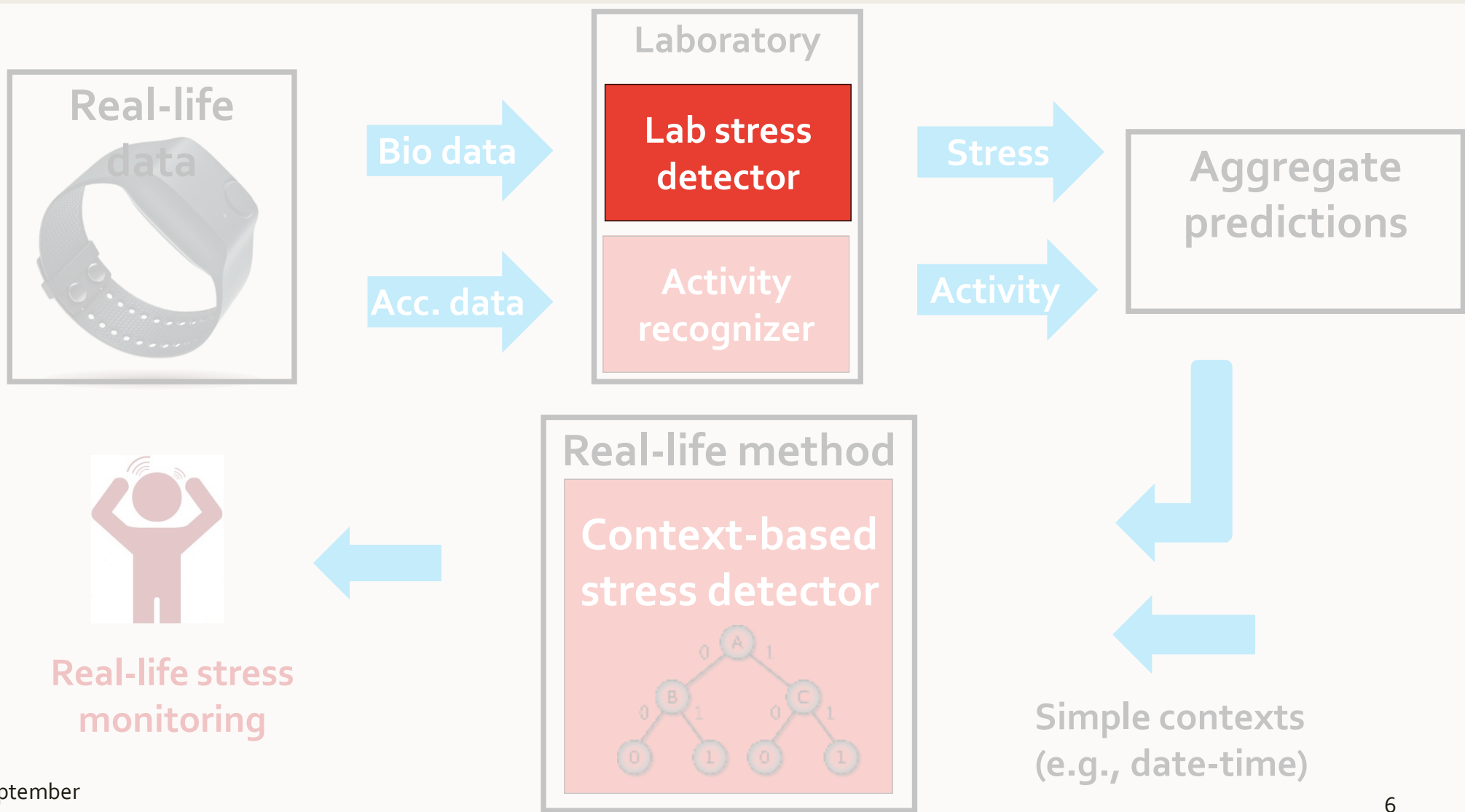
- **Definition (Ice and James)** - "Stress is considered a process by which a stimulus elicits an emotional, behavioral and/or physiological response, which is conditioned by an **individual's personal, biological and cultural context**".



# The method



# The method



# Lab stress detector – Lab data

- Stress inducing – math task under time and evaluation pressure (200 EUR reward for motivation)
- 21 participants x 75 minutes of data per sensor (Heart Rate, Skin Temperature, Blood Volume Pulse, Inter-beat-interval, Electrodermal Activity, Acceleration)



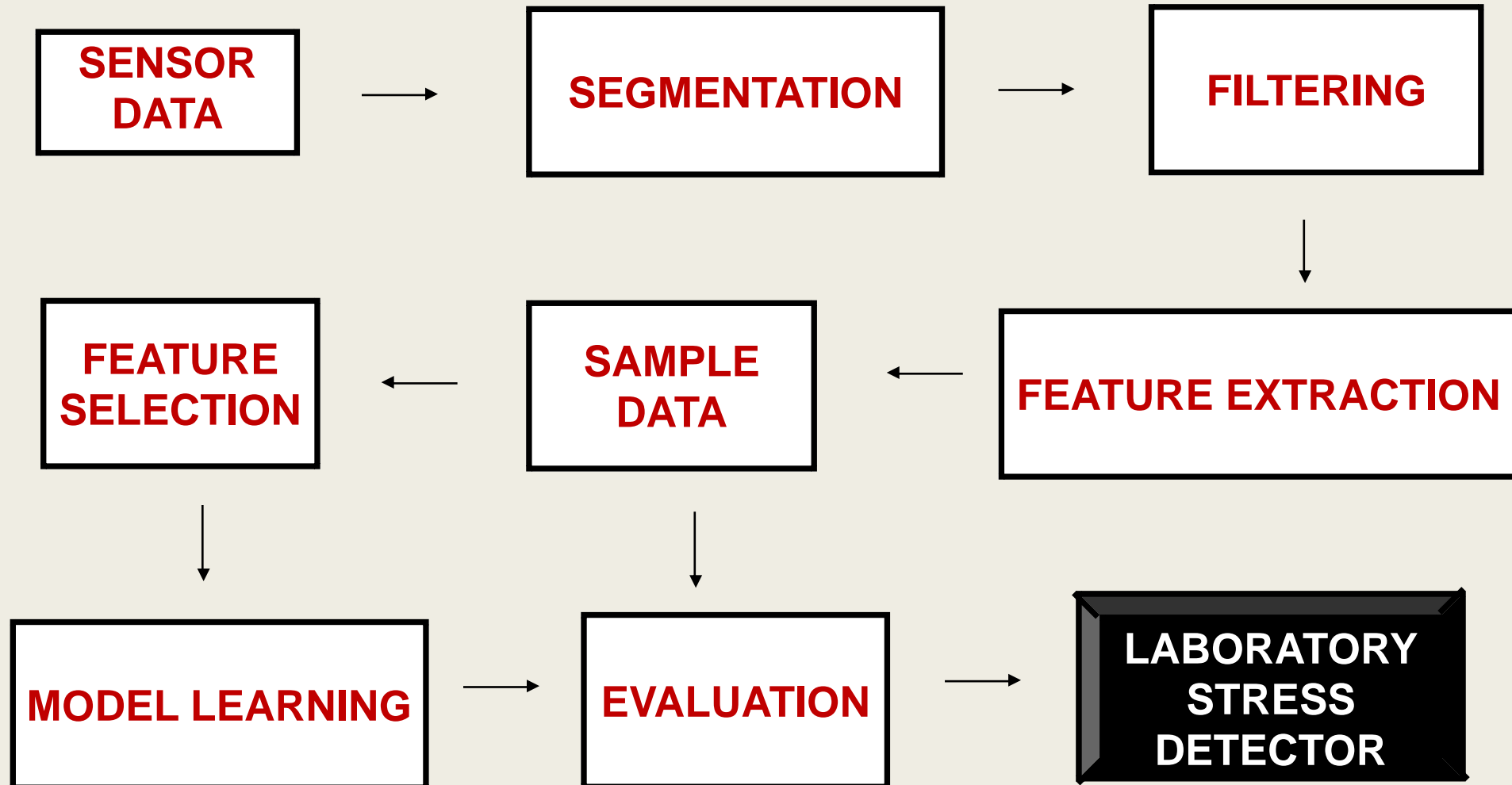
# Lab stress detector – Lab data



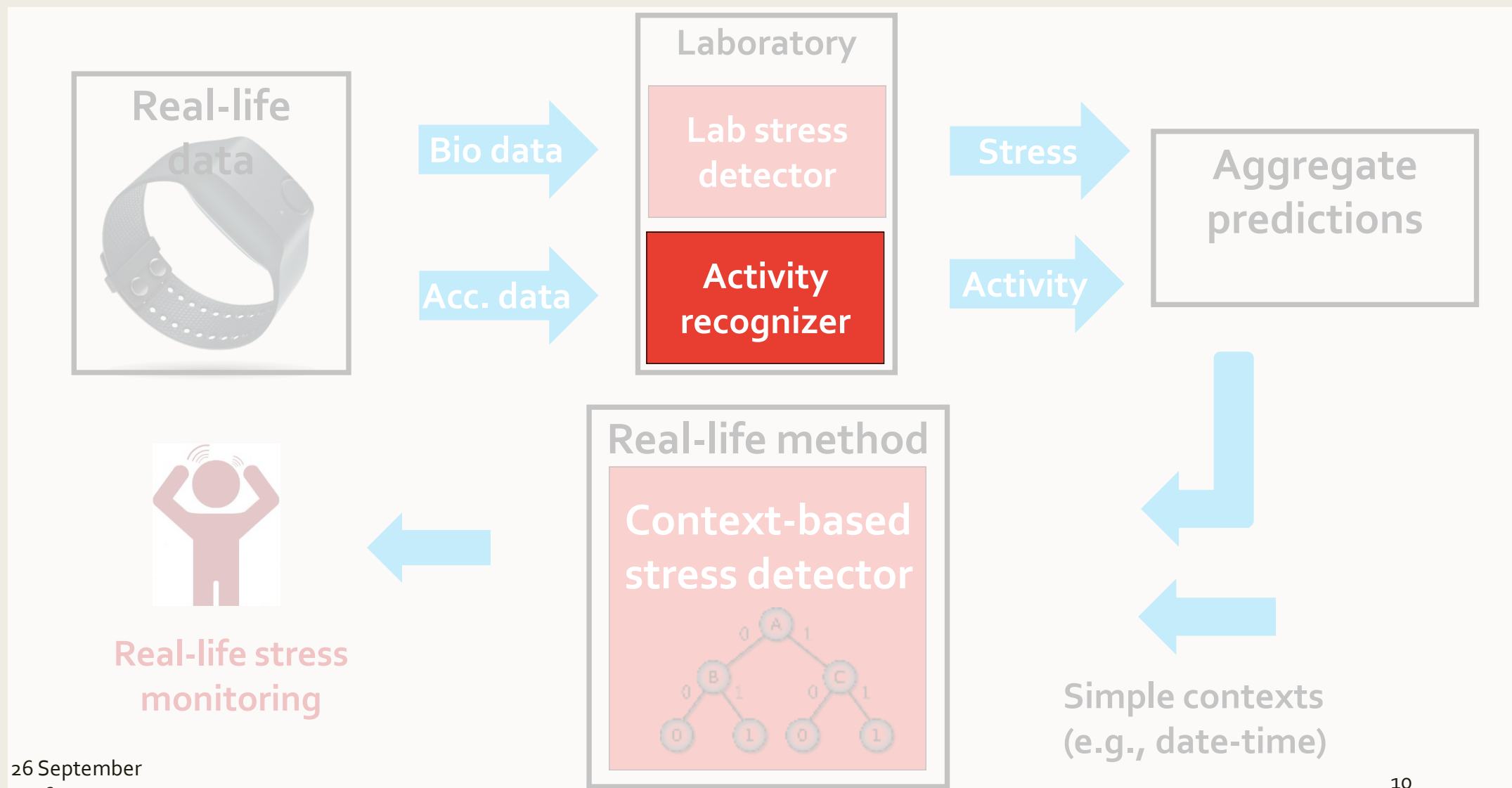
Timing	Anxiety score	# Participants	Labelled Data
Before	10.95	Age Mean	21
After Easy	13.33		28+-4
After Medium	14.05	No Stress	840 minutes
After Hard (End)	13.81	Low Stress	356 minutes
		High Stress	368 minutes



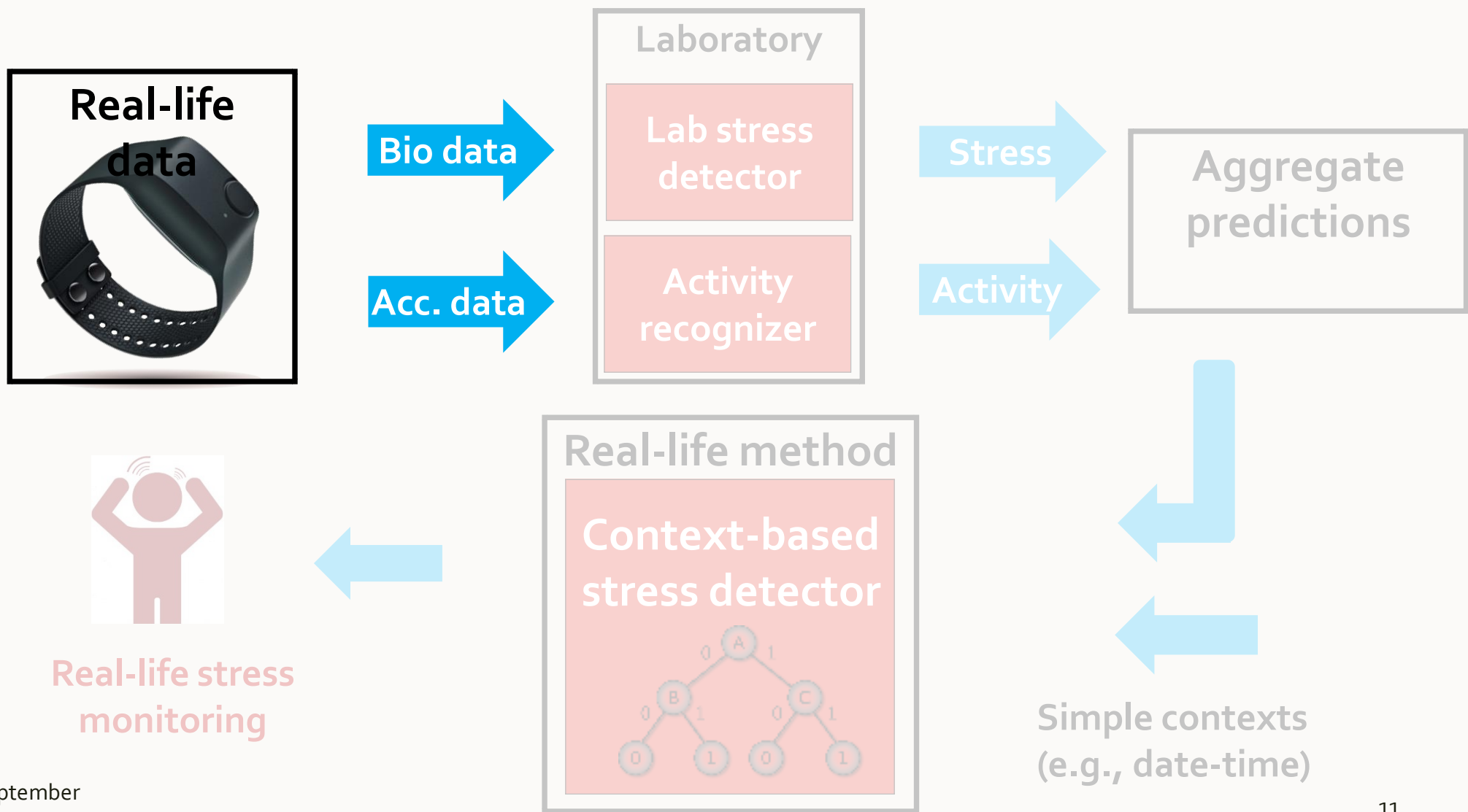
# Lab stress detector – The method



# The method



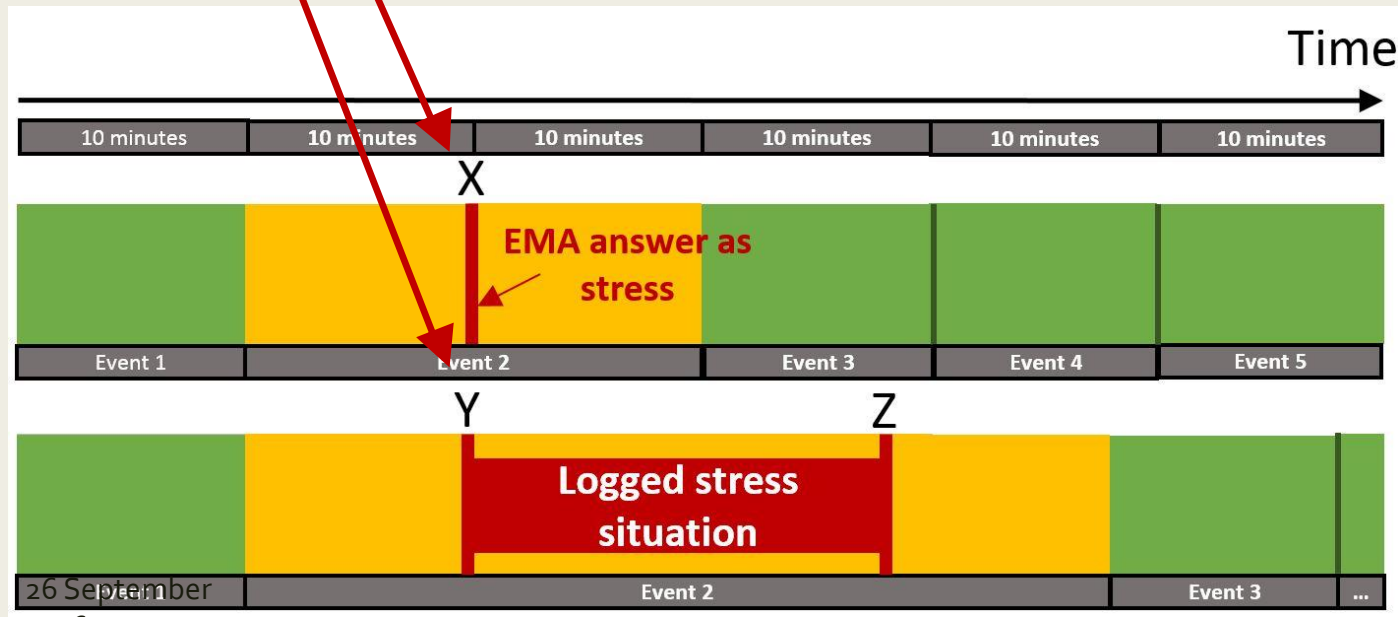
# The method



# Context-based stress detector – Real-life data

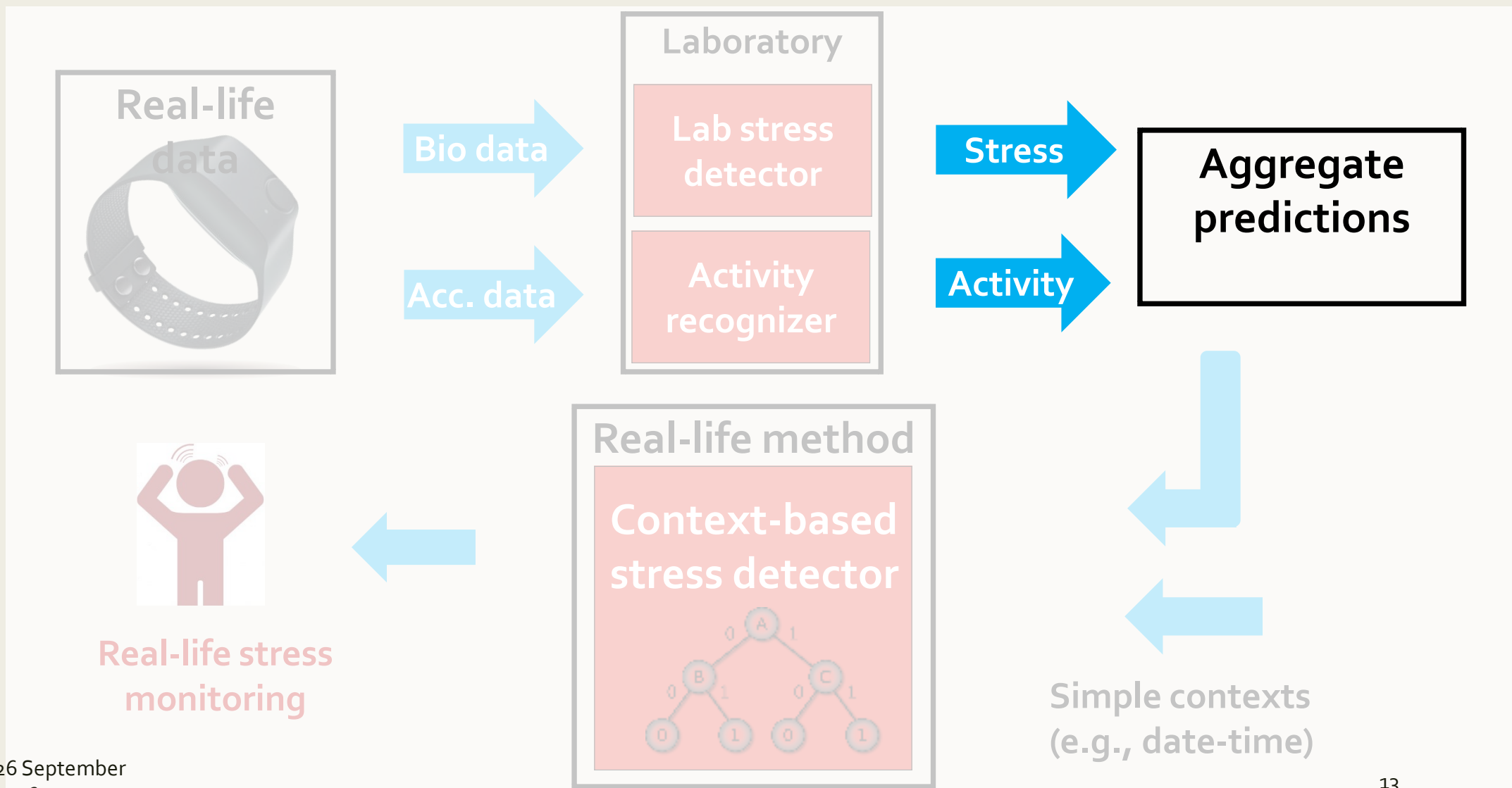
- No constraints at all
- Smartphone application
  - *For assessing stress levels at random periods of the day*
  - *Logger for stressful events*

	Real-life labeled data
# Participants	5
Age Mean	28+-4.3
No Stress	1216 hours
Low Stress	70 hours
High Stress	41 hours

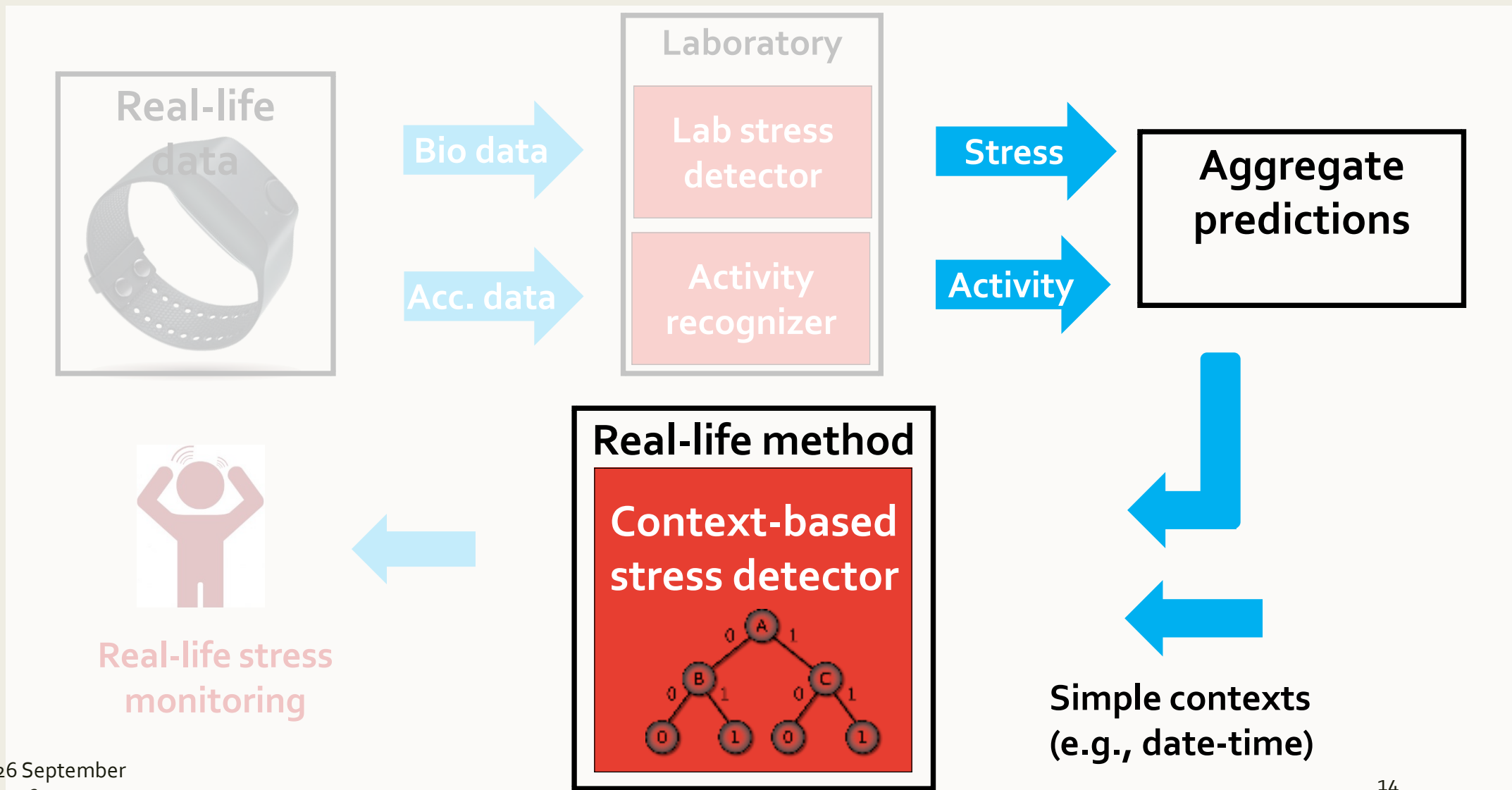


Stress event

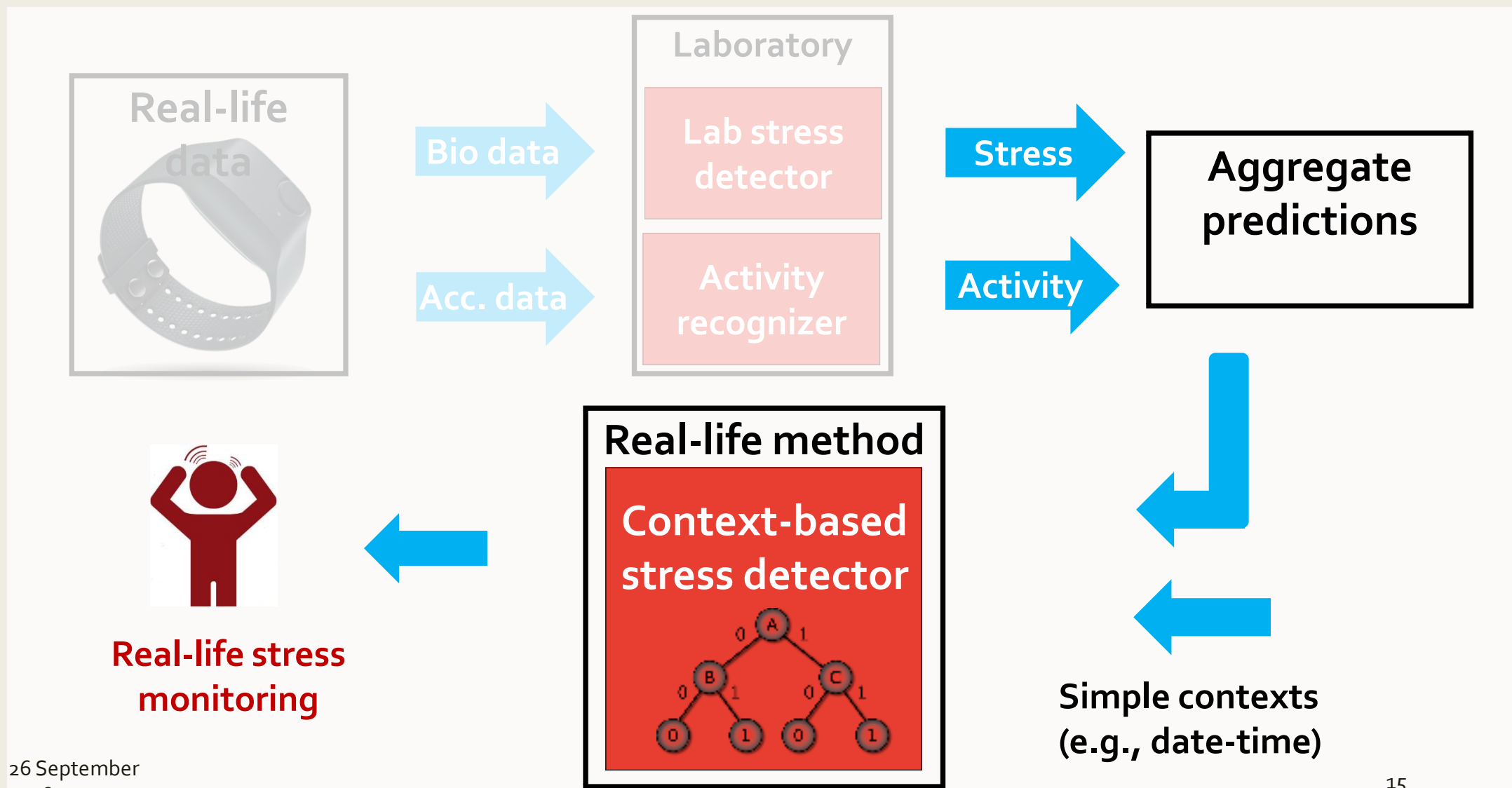
# The method



# The method



# The method



## Context-based stress detector – Experiments (2)

Confusion matrices and evaluation metrics for No-Context vs. With-Context classification. Each number represents an instance/event.

	No-Context		With Context	
	No Stress	Stress	No Stress	Stress
No Stress	3308	1630	4932	6
Stress	34	125	47	112
F1 score	0.80	0.13	0.99 + 0.19	0.81 + 0.68



# Limitations and Future work

## ■ Limitations

- *Sample size*
- *Age structure*



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## ■ Future work

- *More real-life data*
- *Richer context*
- *Personalization*
- *Energy efficiency*

# Conclusions

- We addressed the problem of stress detection in real-life.
  - Data-preprocessing, feature extraction and feature selection methods.
  - Machine learning methods for stress detection in a constrained environments.
  - Context-based method for stress detection in an unconstrained environments.
- The key idea is to use context information.
- Evaluated the proposed method on a real-life data.
  - *the presented context-based method for stress detection detects (recalls) 70% of the stress events with a precision of 95%.*