

# Advanced Temporal Data Abstraction for Guideline Execution

**Andreas Seyfang** and **Silvia Miksch**  
Vienna University of Technology  
Austria

# Overview

- Motivation
  - Why Guideline Execution
  - Why Temporal Data Abstraction
- Definitions
- Abstractions with example
- Strength & limitations

# Why Guideline Execution?

- Deliver the right recommendation at the right time
  - Reduce information overload
  - Improve quality of health care
- Prerequisites
  - Information about patient state
  - Formal representation of guideline

# Why Data Abstraction?

- Integration into clinical data flow necessary

Additional data entry

= additional work

= barrier to usage of  
guideline execution system

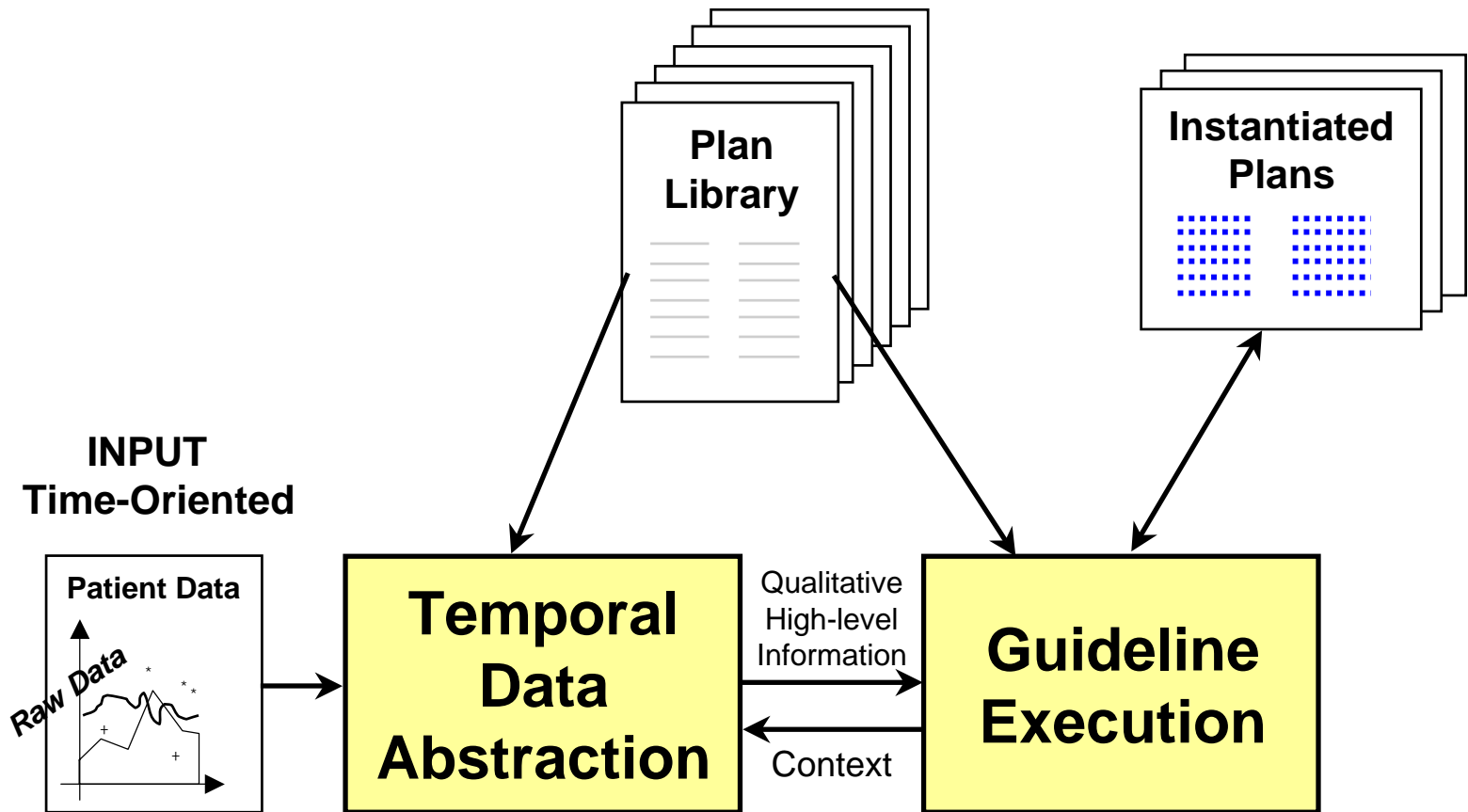
# Why Data Abstraction?

- Integration into clinical data flow necessary
- Gap between raw data and medical concepts
  - Quantitative raw data:
    - 11:23:05 SpO2=96%
    - 11:23:06 SpO2=95%
    - 11:23:07 SpO2=96%
  - Qualitative medical concept:  
sufficient oxygen supply in artificial ventilation

# Why *Temporal* Data Abstraction?

- Temporal dimension crucial part of medical concepts (often implicit)
  - *Recent* readings of SpO<sub>2</sub>
- Combinations of different time windows necessary
  - Short term trend can invalidate long term observation

# The Big Picture



# Definitions

- Parameter = Variable plus history of measurements
- Episode = period of time during which a parameter has a certain value
- Parameter proposition
  - = parameter
  - + value constraint
  - + context
  - + temporal constraints

# Simple Example

In artificial ventilation, hypoxic episode is a period of time lasting longer than 4 seconds during which the SpO<sub>2</sub> reading is below 80.

- Solution
  - Parameter proposition
  - Parameter name: SpO<sub>2</sub>
  - Value constraint: less than 80
  - Context: artificial ventilation
  - Minimum duration: 4 seconds

# Abstractions

- Qualitative values
- Sliding time windows
- Statistical measures
- Time/date oriented abstraction
- Repetitions

# Combinations/Temporal Patterns

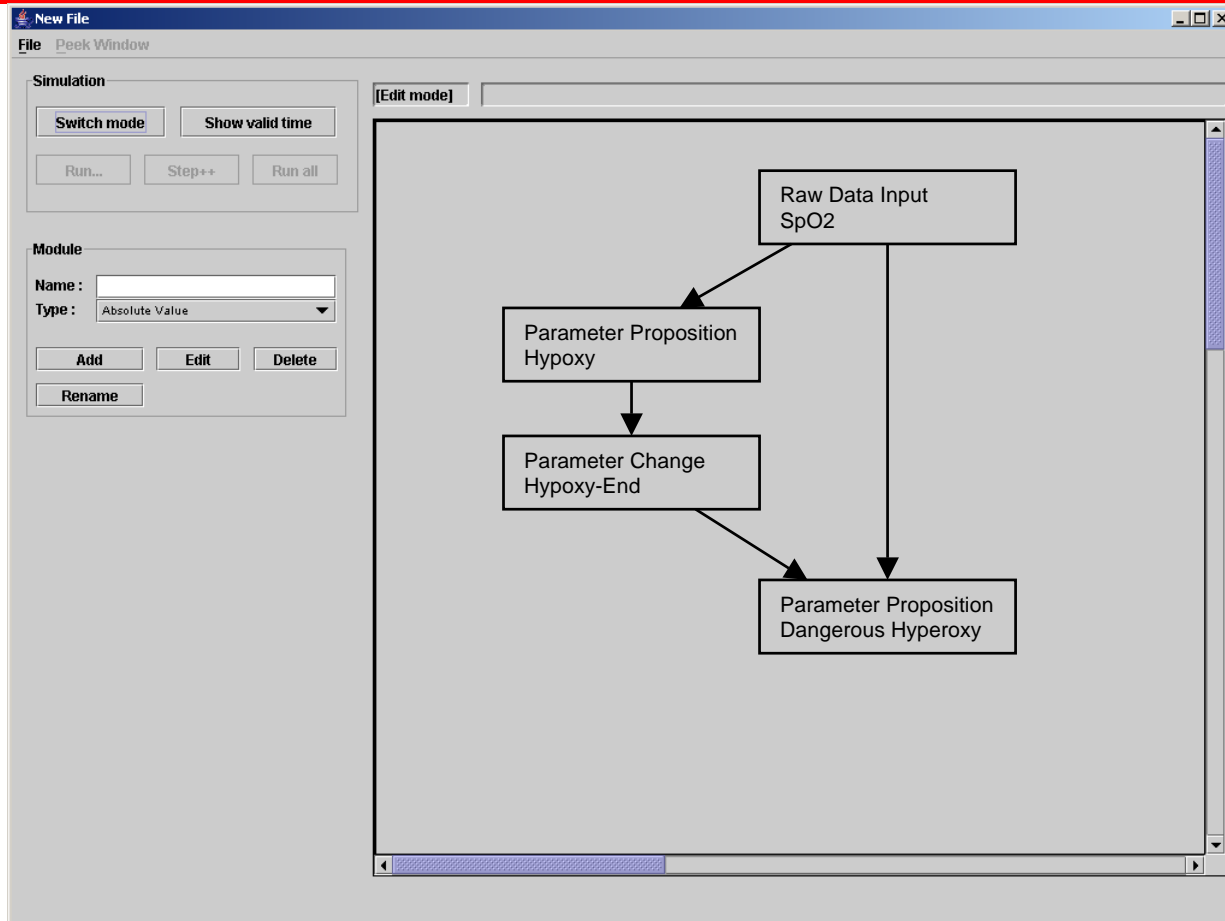
- Logical
  - and, or
- Arithmetic
  - sum, difference
- Different parameter propositions
- Aggregates of different time ranges

# Complex Example

Overshooting hyperoxy is an episode of dangerously increased SpO<sub>2</sub> which starts at less than 20 seconds after a hypoxic episode. SpO<sub>2</sub> > 96 considered dangerous.

- Solution
  - Hypoxy as before
  - Hyperoxy similar but time constraint:  
Latest start 20 seconds after end of hypoxy

# Interactive Configuration



# Strengths

- Detection of episodes
- Aggregates for sliding time windows
- Monitoring of repetitions
- Free combination of abstractions

# Limitations

- Knowledge acquisition
- Access to *all* required inputs
- Integration with precise formalized guideline
  
- Some abstractions not implemented

# Conclusion

- Guideline execution needs temporal data abstraction
- Temporal data abstraction needs guideline execution