An Algorithm, Implementation and Execution Ontology Design Pattern

Agnieszka Ławrynowicz[1], Diego Esteves[2], Panče Panov[3], Tommaso Soru[2], Sašo Džeroski[3] and Joaquin Vanschoren[4]

[1]Faculty of Computing, Poznan University of Technology, Poznan, Poland
[2]AKSW, University of Leipzig, Germany
[3]Department of Knowledge Technologies, Jožef Stefan Institute, Ljubljana, Slovenia
[4]Eindhoven University of Technology, The Netherlands

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MLSchema

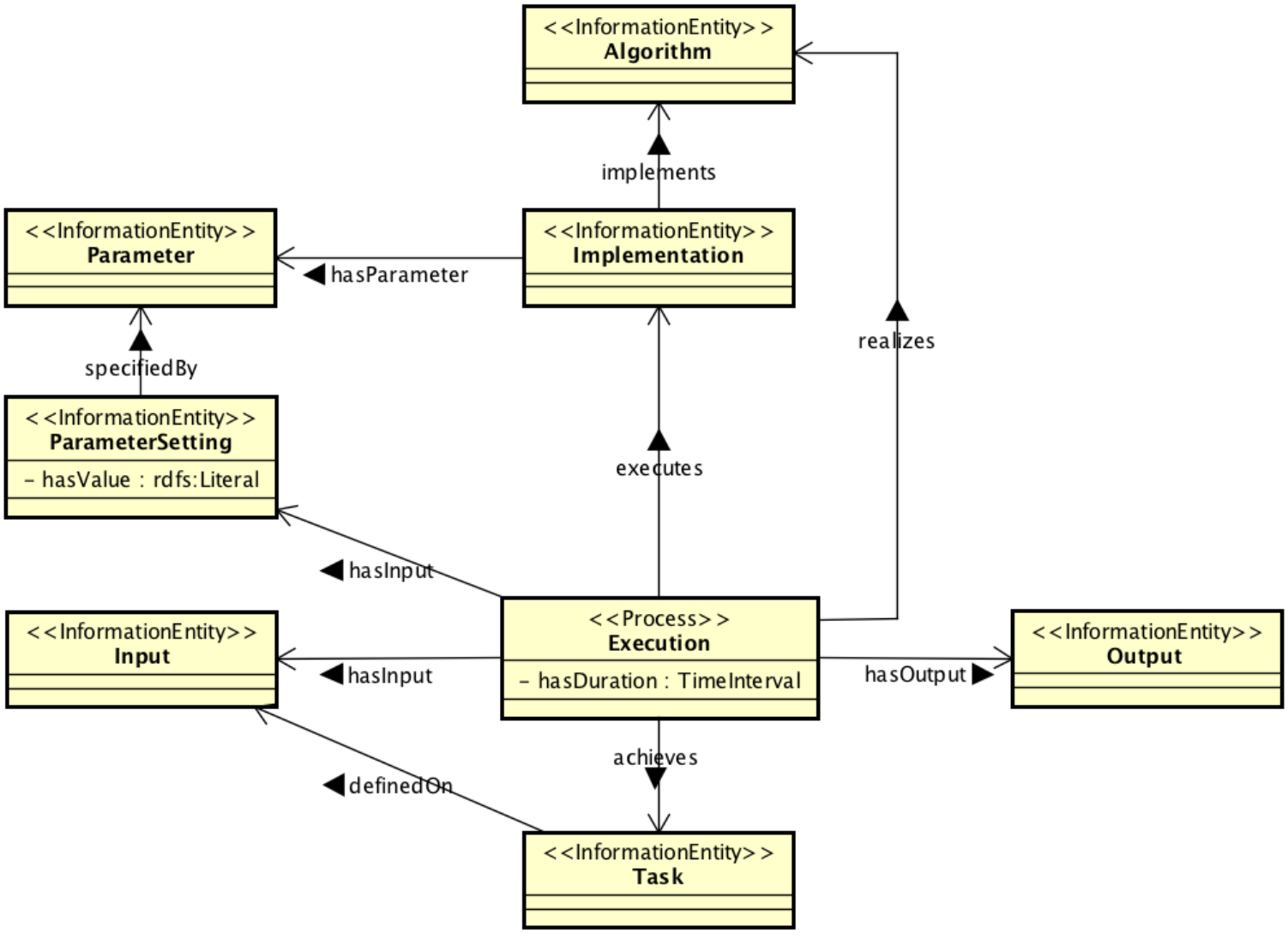
Intent

The intent of the design pattern is to model algorithm specifications, their implementations and executions. This includes also the parameters of implementations, settings of these parameters for a specific execution, as well as the inputs that the execution consumes (e.g., data) and the outputs it produces (e.g., models, reports).

Competency questions

- Which algorithm is implemented by this implementation?
- What are the implementations of this algorithm?
- Which implementation is executed?
- What are the parameters of this implementation?
- What are the parameter settings of particular parameters in this execution?
- What is the input to this implementation execution?
- What is the output produced by this implementation execution?
- What algorithm does this execution realize?
- What task does this execution achieves?
- What is the duration of this execution?
- What are the inputs this task is defined on?

An Algorithm, Implementation and Execution ODP

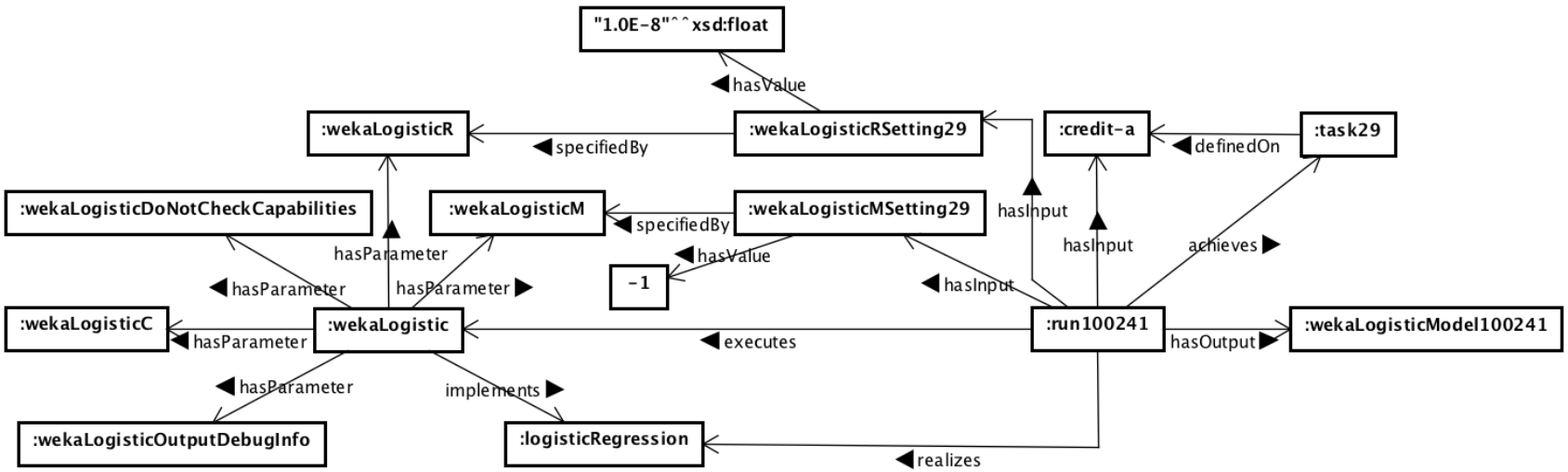


Pattern formalization

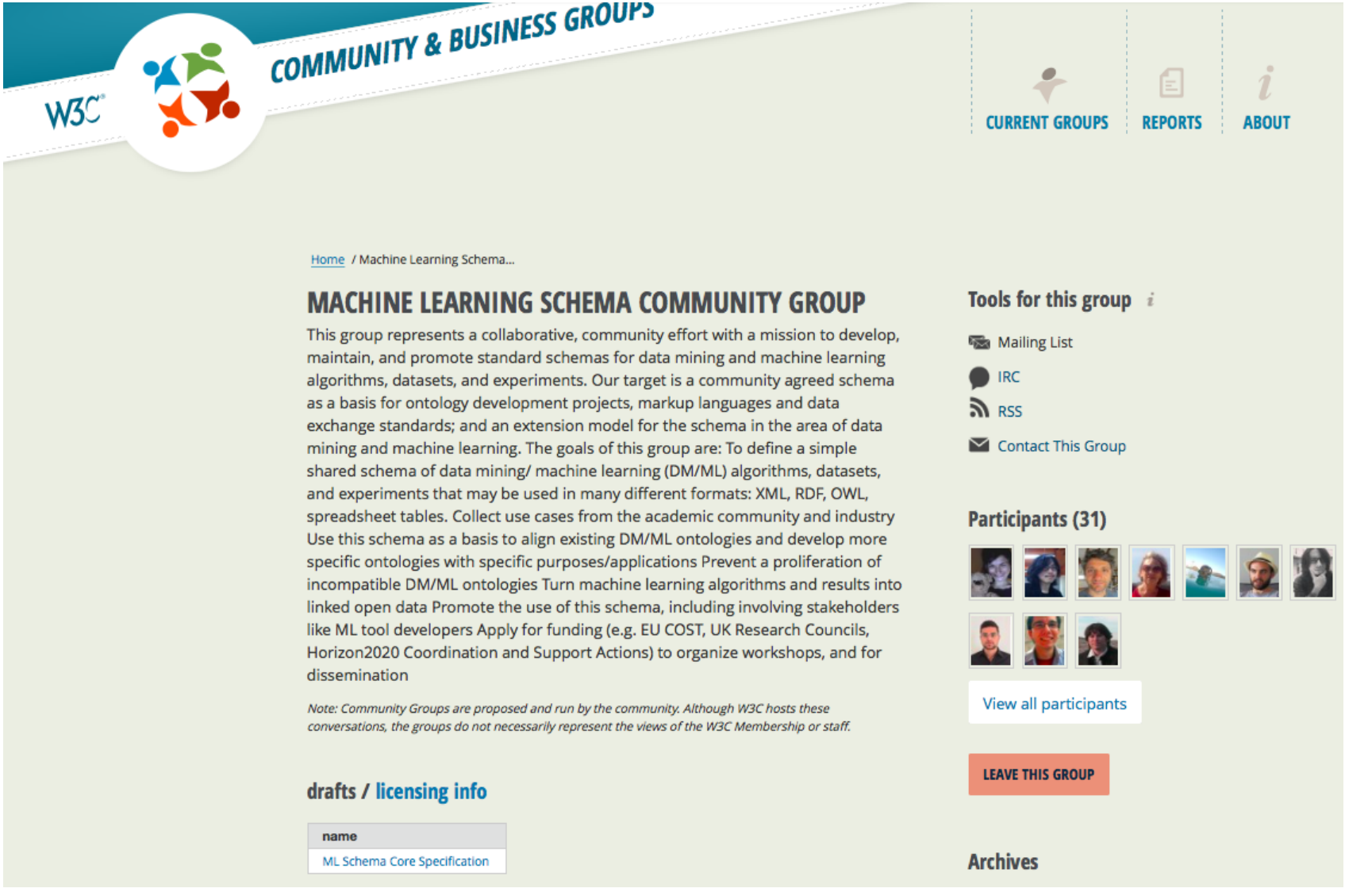
$$
\begin{aligned}
\text{Algorithm} &\sqsubseteq \text{InformationEntity} \\
\text{Implementation} &\sqsubseteq \text{InformationEntity} \\
\text{Implementation} &\sqsubseteq \exists \text{implements}.\text{Algorithm} \\
\text{Implementation} &\sqsubseteq \exists \text{hasParameter}.\text{Parameter} \\
\text{Execution} &\sqsubseteq \text{Process} \\
\text{Execution} &\sqsubseteq \exists \text{hasInput}.\text{ParameterSetting} \\
\text{Execution} &\sqsubseteq \exists \text{realizes}.\text{Algorithm} \\
\text{Execution} &\sqsubseteq \exists \text{achieves}.\text{Task} \\
\text{Execution} &\sqsubseteq \exists \text{hasDuration}.\text{TimeInterval} \\
\text{Parameter} &\sqsubseteq \text{InformationEntity} \\
\text{ParameterSetting} &\sqsubseteq \text{InformationEntity} \\
\text{ParameterSetting} &\sqsubseteq \exists \text{specifiedBy}.\text{Parameter} \\
\text{ParameterSetting} &\sqsubseteq \exists \text{hasValue}.\text{rdfs} : \text{Literal} \\
\text{Input} &\sqsubseteq \text{InformationEntity} \\
\text{Output} &\sqsubseteq \text{InformationEntity} \\
\text{Task} &\sqsubseteq \text{InformationEntity} \\
\text{Task} &\sqsubseteq \exists \text{definedOn}.\text{Input} \\
\top &\sqsubseteq \forall \text{hasInput}.\text{Input} \\
\top &\sqsubseteq \forall \text{hasOutput}.\text{Output}
\end{aligned}
$$

Example scenario: Machine Learning Domain

The scenario deals with an ML task realization based on an example derived from the OpenML portal.



W3C ML Schema Group



Thank you!