A Combined Finite State Machine and PlantUML Approach to Machine Learning Applications

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Agenda

1. Requirements
2. A FSM Architecture for Explanatory AI
3. Frameworks: AI, AutoML and AutoGluon
4. Automated Tools: PlantUML DSL, PyParsing and FSM/Miros
5. An Example: AutoGluon Time Series Automation
6. Datasets: PlantUML Diagrams
7. Conclusion

Requirements

I. Requirements for the FSM-driven AutoML

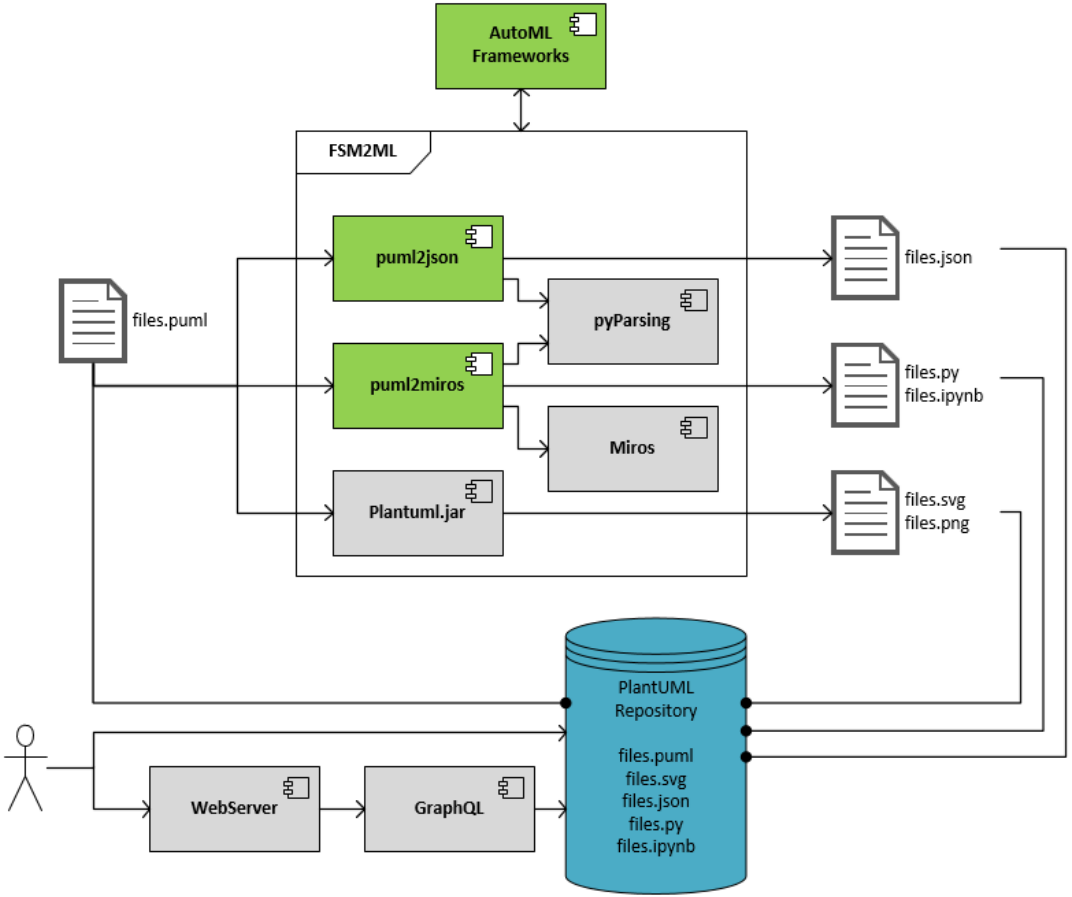
1. Exchange data files with any of the existing AutoML platforms;
2. Manipulate PlantUML diagrams in any shape possible;
3. Apply logic operations on PlantUML diagrams;
4. Apply the reasoning logic on FSM diagrams represented in PlantUML;
5. Run the code associated with any PlantUML diagrams;
6. Apply ElasticSearch on the PlantUML diagram repositories;

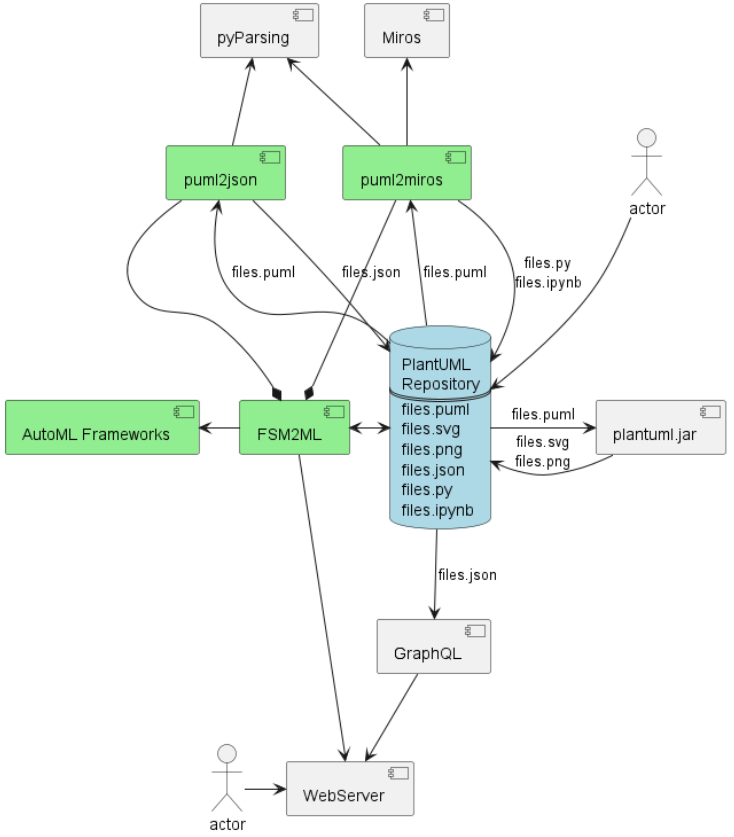
Requirements

II. Requirements for the UI/UX

7. Browse existing diagrams;
8. Select components via a pin-down mechanism;
9. Display running results inside PlantUML diagrams;
10. Reuse fragments of existing PlantUML diagrams;
11. Expand/collapse PlantUML nested components;
12. Expand/collapse headings sections within a component;
13. Expand/collapse special "more" nodes in order to zoom in/out parts;
14. The above requirements apply verbatim to FSM diagrams;

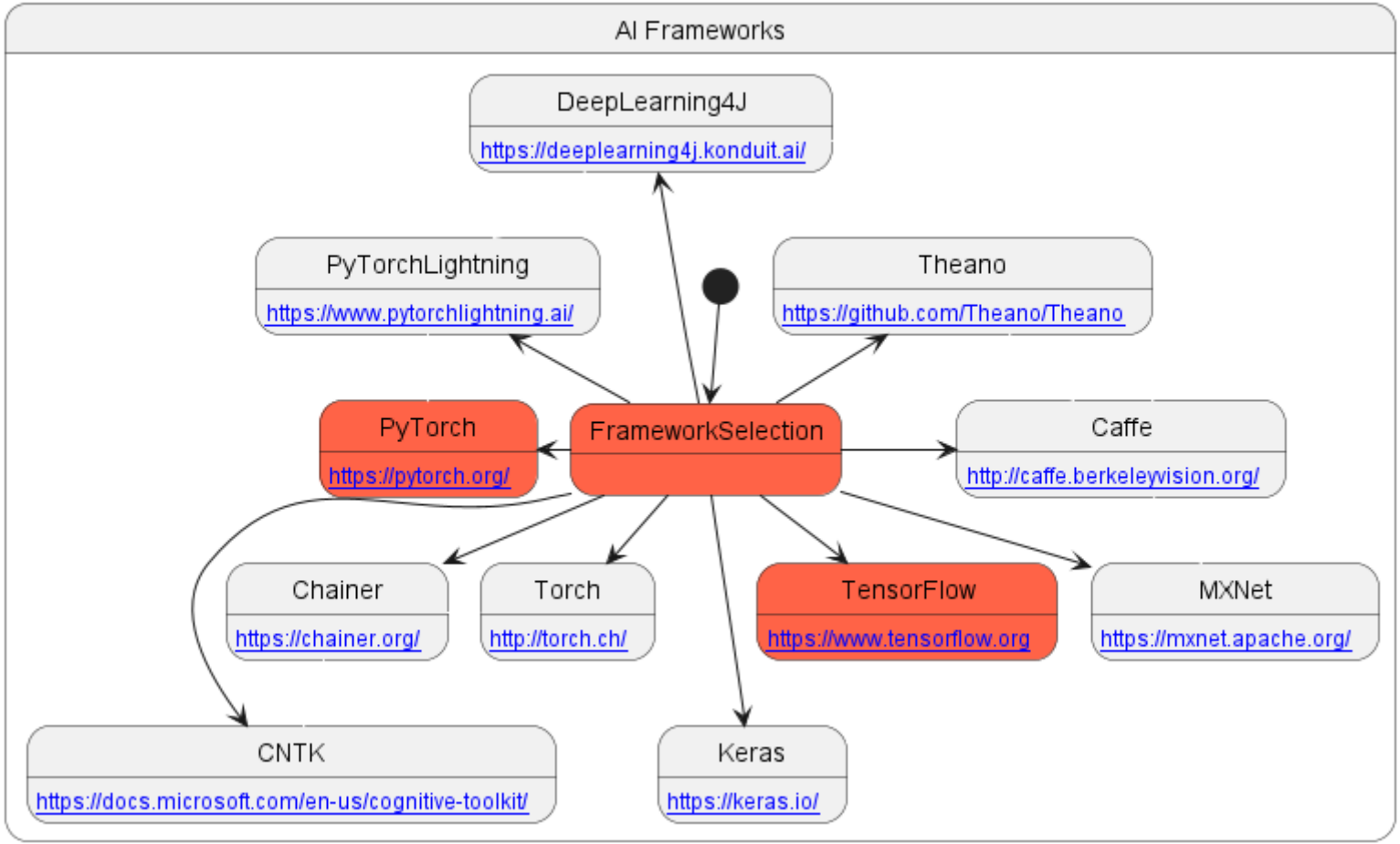
A FSM Architecture for Explanatory AI



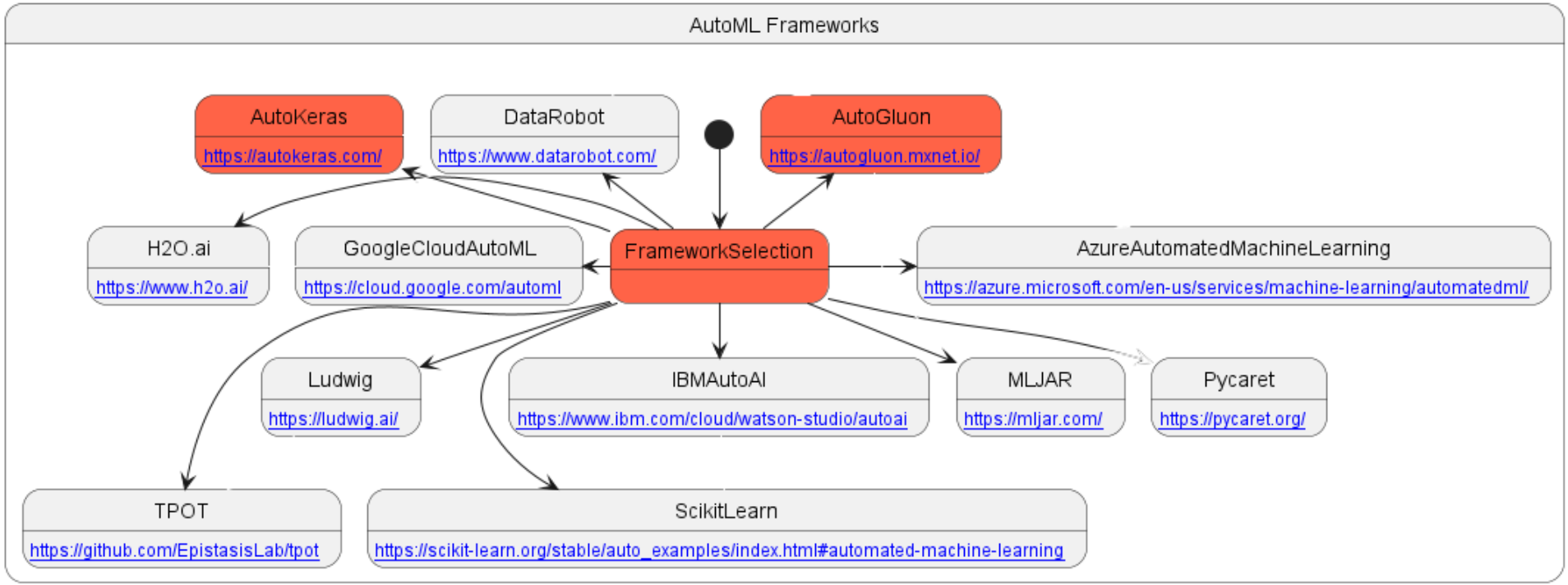


PlantUML

AI Frameworks

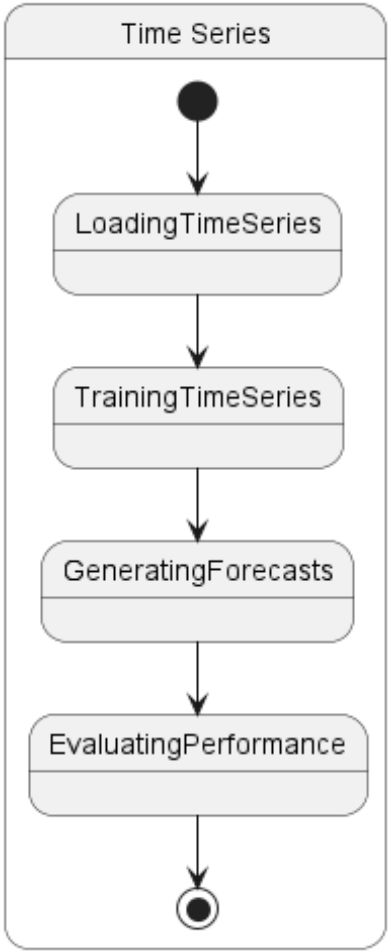


AutoML Frameworks

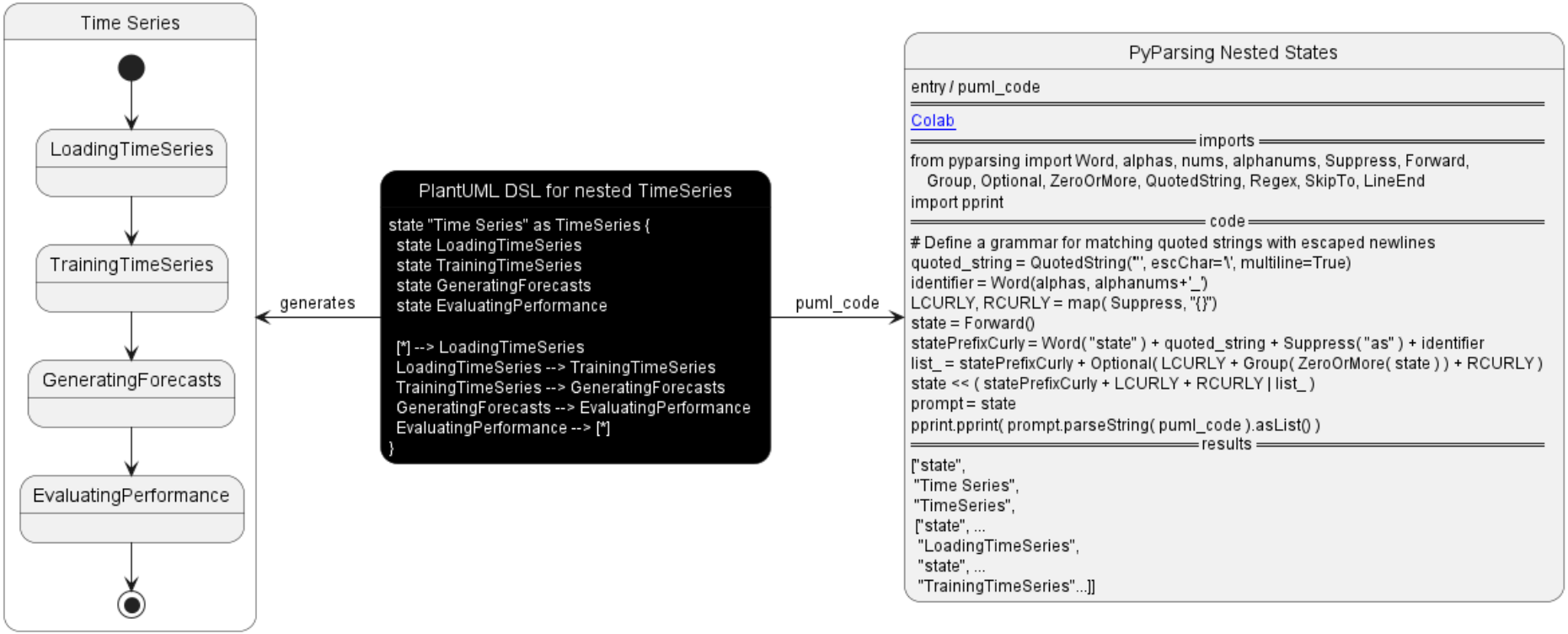


Tools :: PlantUML DSL

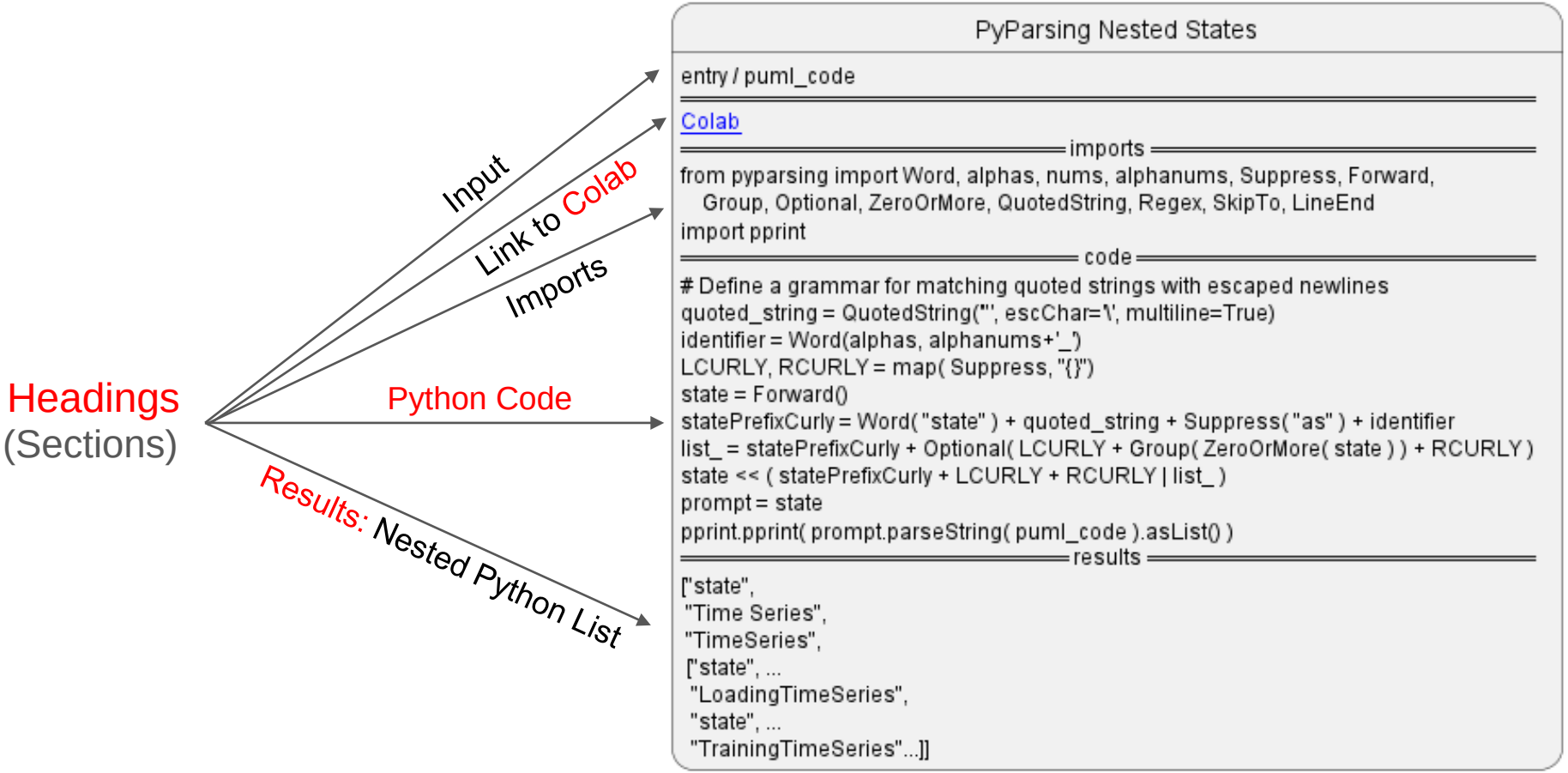
```
@startuml

state "Time Series" as TimeSeries {
  state LoadingTimeSeries
  state TrainingTimeSeries
  state GeneratingForecasts
  state EvaluatingPerformance

  [*] --> LoadingTimeSeries
  LoadingTimeSeries --> TrainingTimeSeries
  TrainingTimeSeries --> GeneratingForecasts
  GeneratingForecasts --> EvaluatingPerformance
  EvaluatingPerformance --> [*]
}

@enduml
```



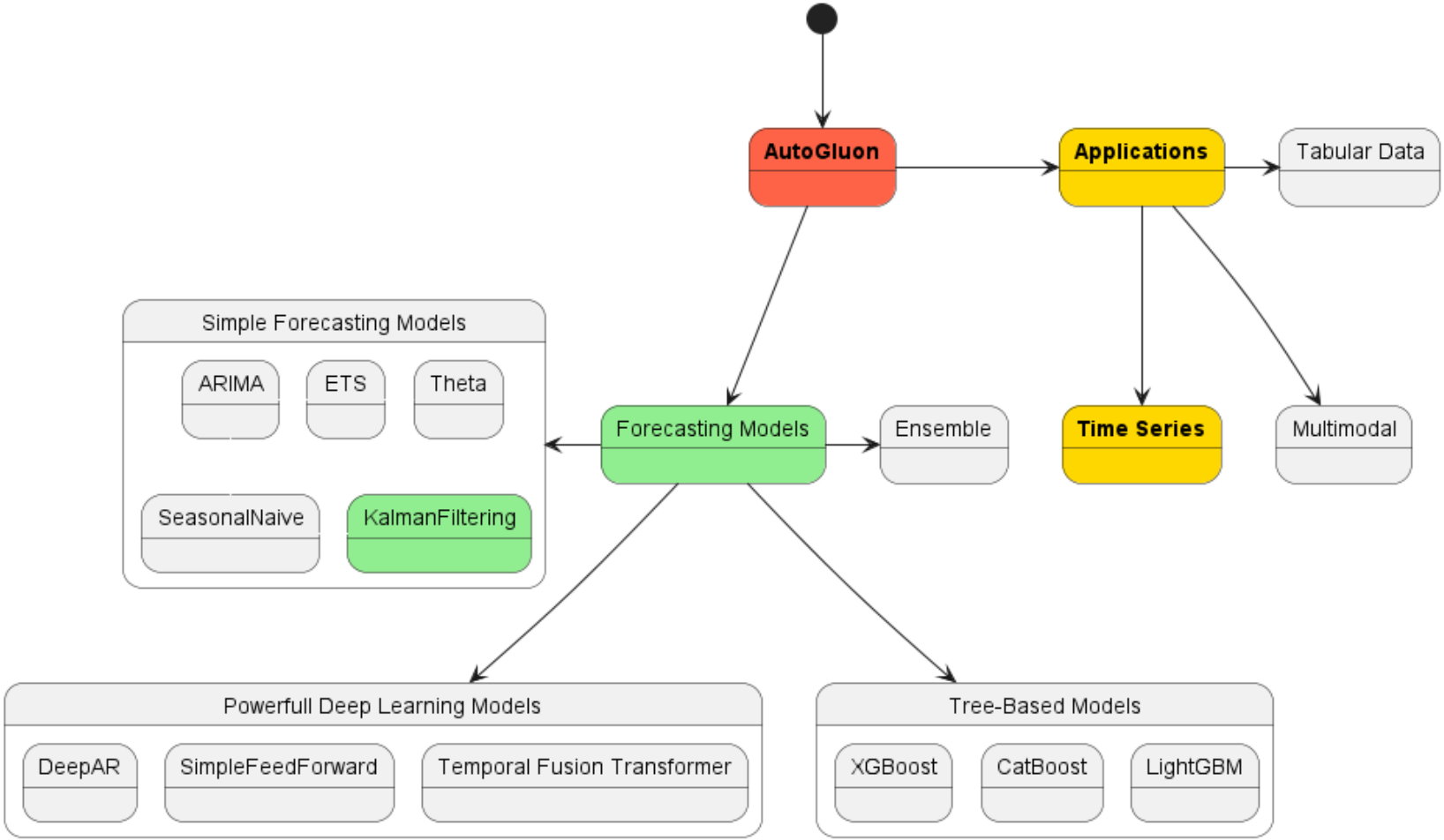
Tools :: PlantUML DSL and PyParsing Transformation



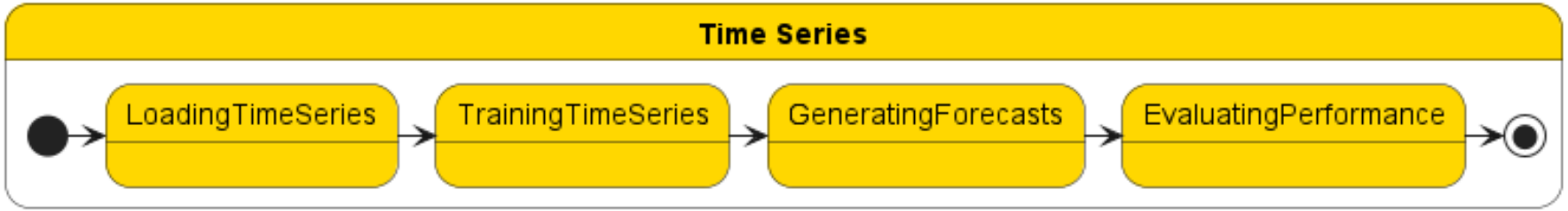
Tools :: PyParsing Nested States



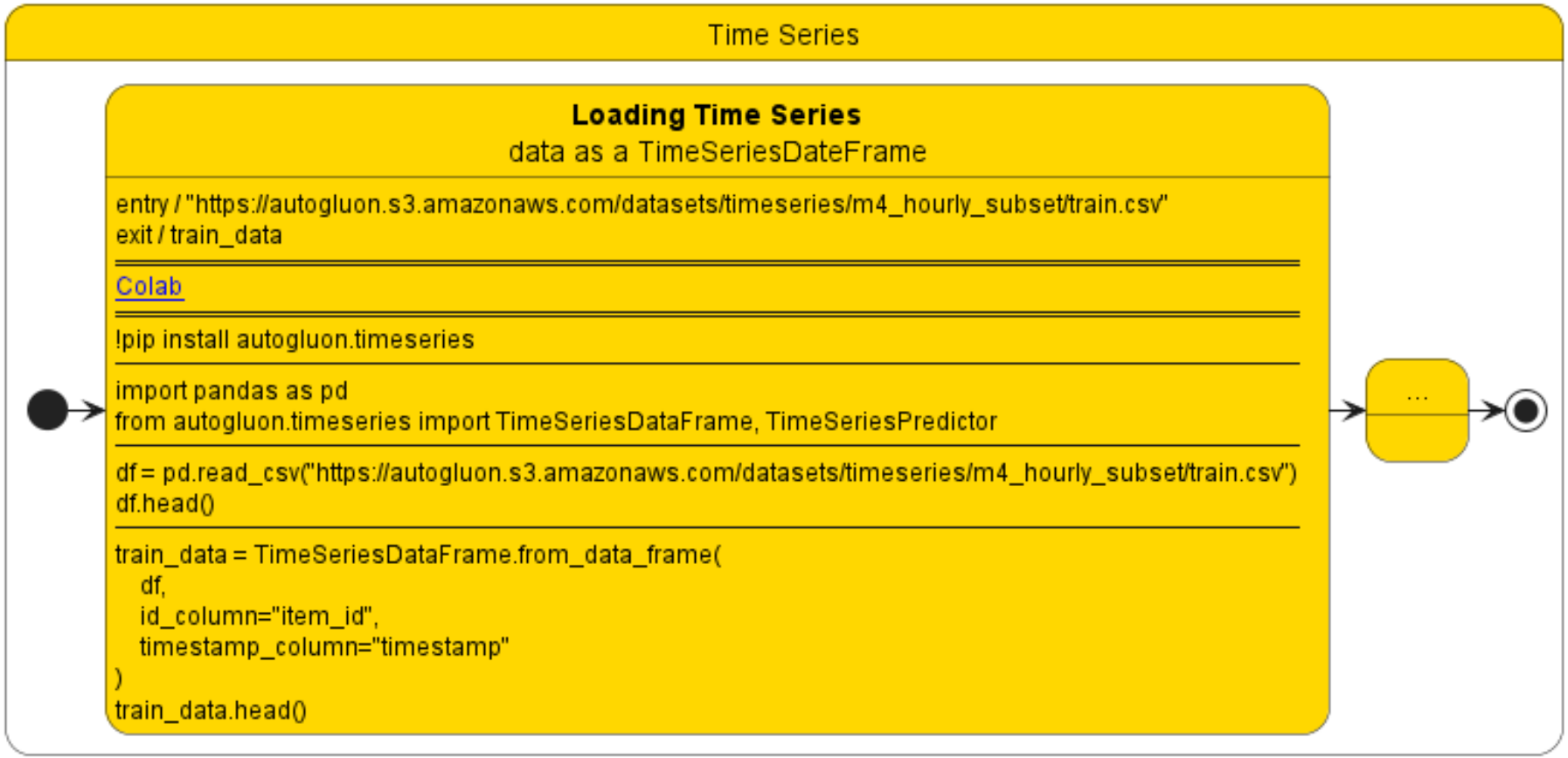
FSM for AutoGluon Models and Applications



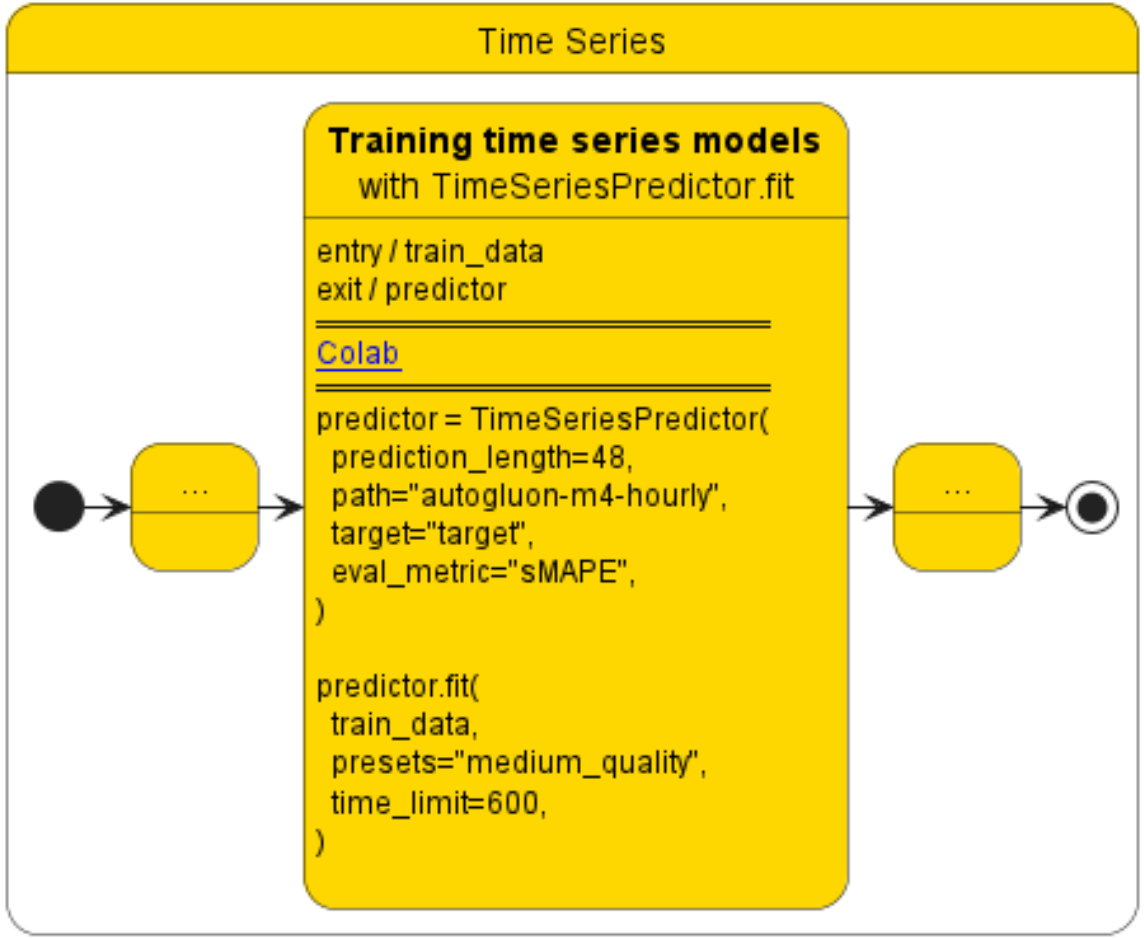
AutoGluon :: Applications :: TimeSeries



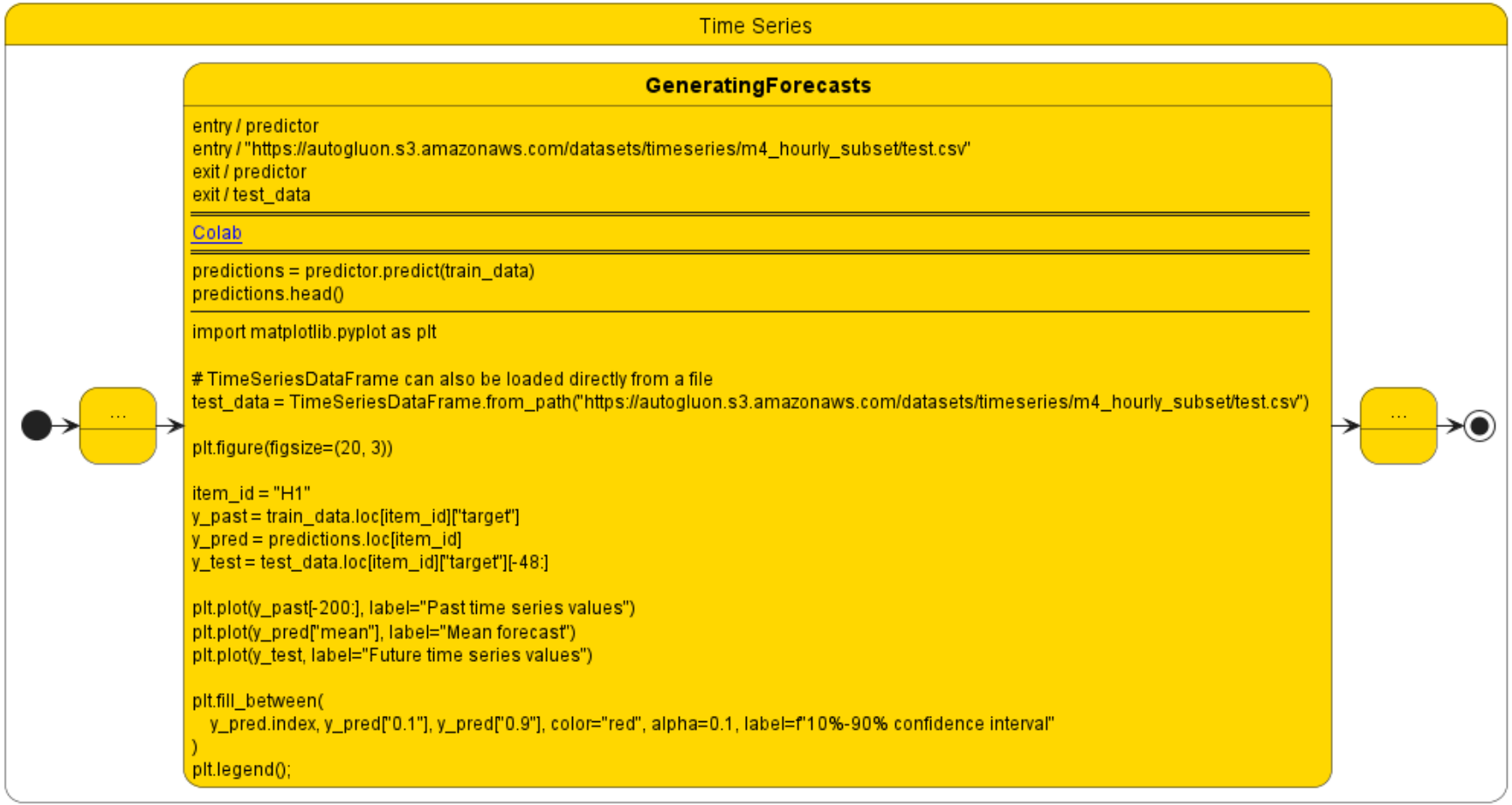
AutoGluon :: Applications :: TimeSeries :: LoadingTimeSeries



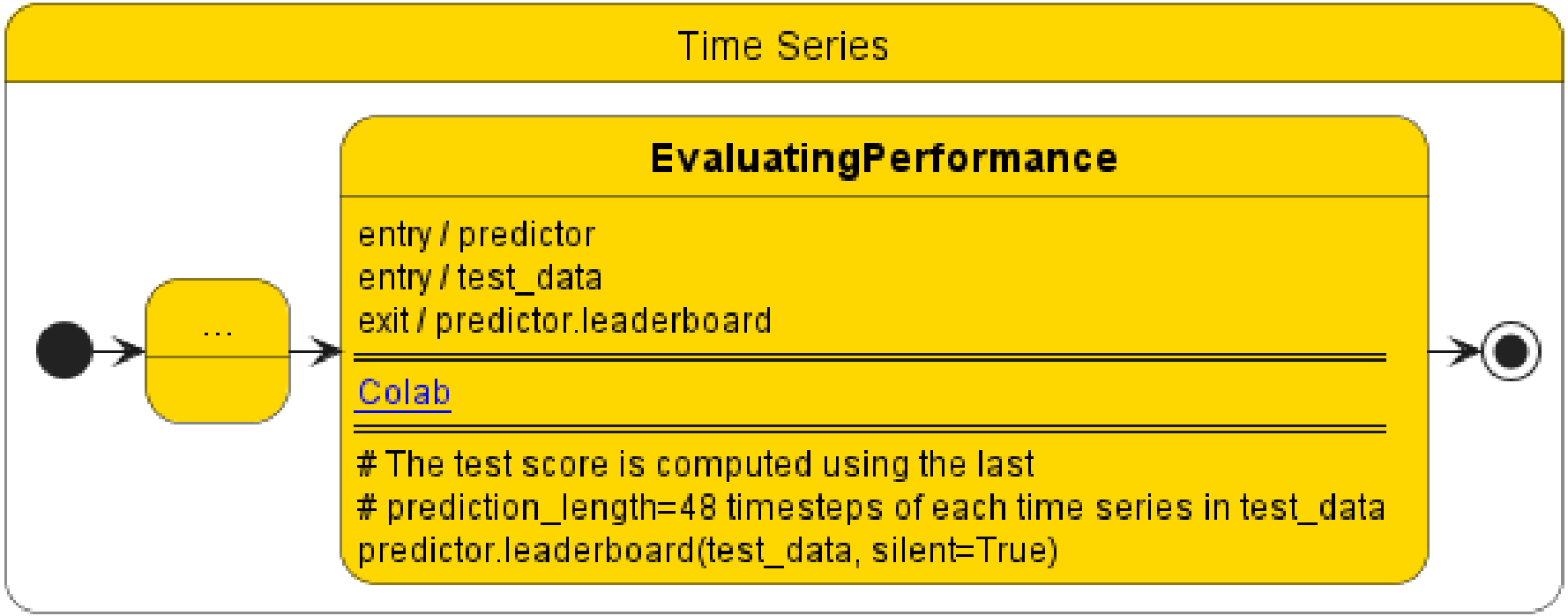
AutoGluon :: Applications :: Time Series :: Training



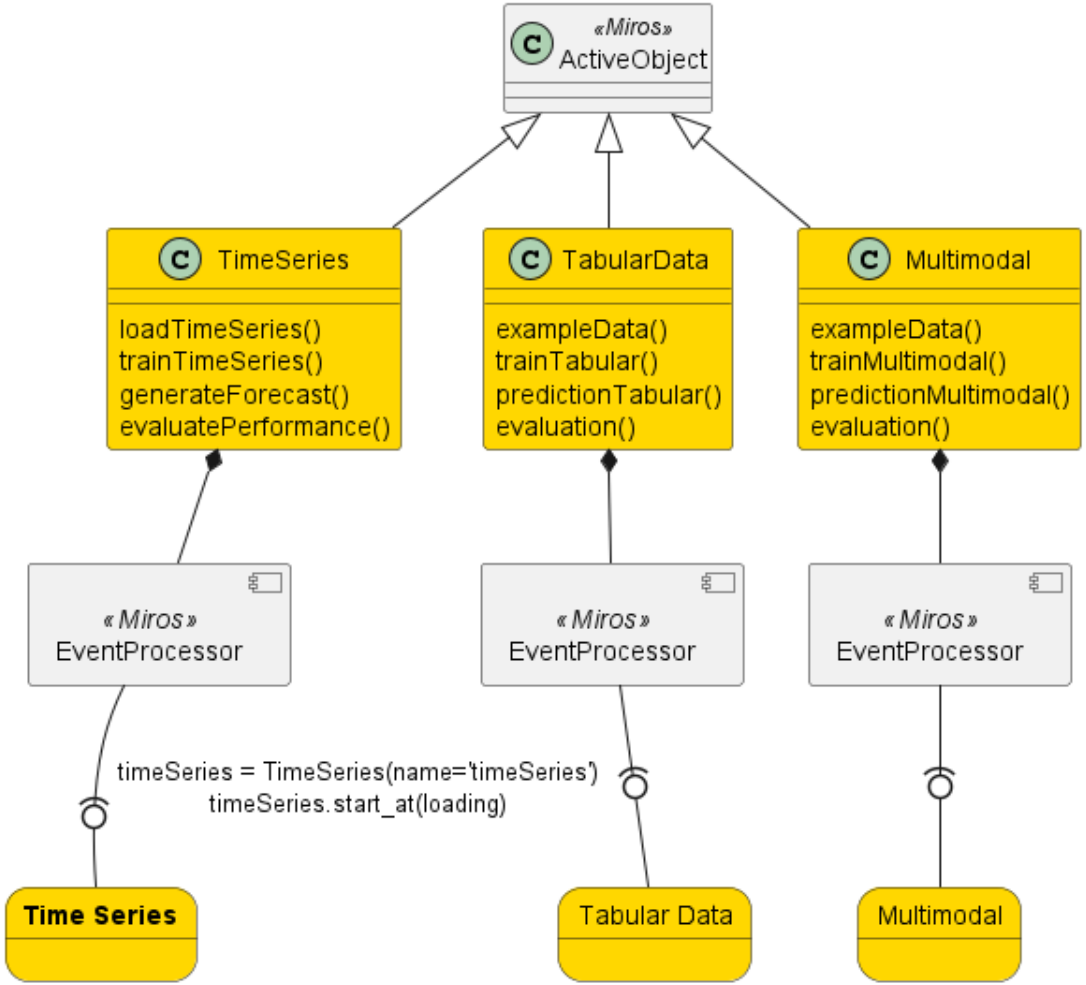
AutoGluon :: Applications :: Time Series :: GeneratingForecasts



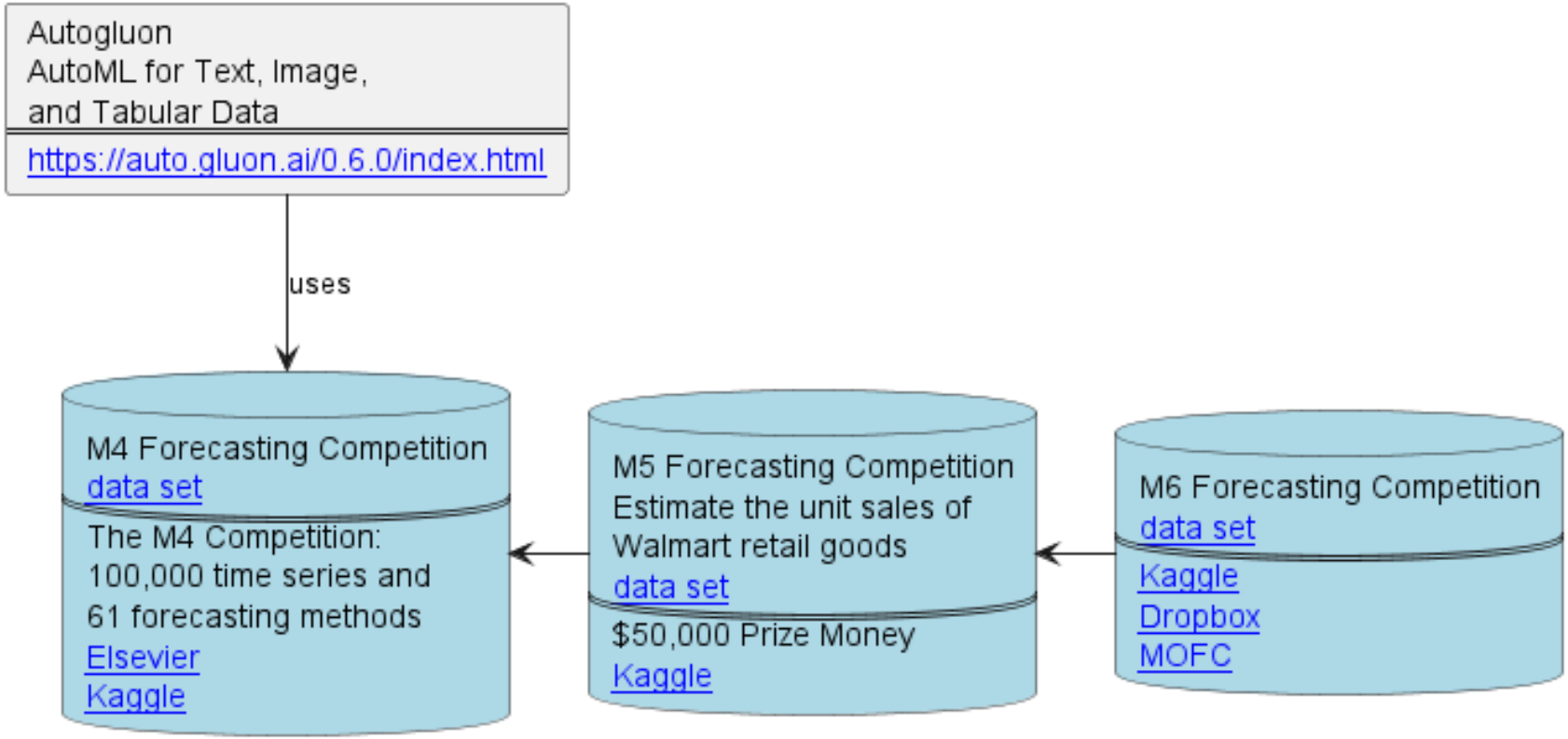
AutoGluon :: Applications :: TimeSeries :: EvaluatingPerformance



Tools :: Miros


«Miros»
ActiveObject
TimeSeries
loadTimeSeries()
trainTimeSeries()
generateForecast()
evaluatePerformance()
TabularData
exampleData()
trainTabular()
predictionTabular()
evaluation()
Multimodal
exampleData()
trainMultimodal()
predictionMultimodal()
evaluation()
«Miros»
EventProcessor
«Miros»
EventProcessor
«Miros»
EventProcessor
timeSeries = TimeSeries(name='timeSeries')
timeSeries.start_at(loading)
Time Series
Tabular Data
Multimodal

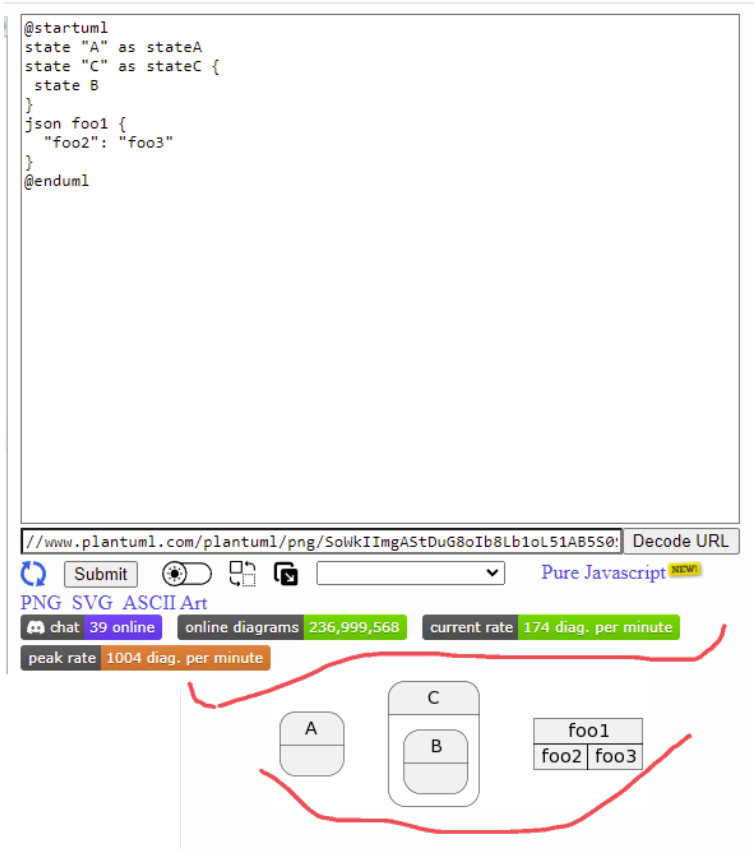
Datasets


Autogluon
AutoML for Text, Image,
and Tabular Data
https://auto.gluon.ai/0.6.0/index.html
uses
M4 Forecasting Competition
data set
The M4 Competition:
100,000 time series and
61 forecasting methods
Elsevier
Kaggle
M5 Forecasting Competition
Estimate the unit sales of
Walmart retail goods
data set
$50,000 Prize Money
Kaggle
M6 Forecasting Competition
data set
Kaggle
Dropbox
MOFC

More Datasets

- Generating PlantUML diagrams = A Generative FSM Tool

- Online Diagrams Corpus Counter:
  236,999,568 - diagrams



Conclusion

1. FSM frameworks and tools are built for AI and AutoML (AutoGluon) development.
2. A FSM architecture for explanatory AI provides powerful insights into model decision-making.
3. Tools such as PlantUML, PyParsing, and Miros are used to build complex FSM models.
4. Datasets are an essential part of the development process.
5. The AutoGluon Time Series used for forecasting are represented in FSM form.

References

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- F. Hutter, L. Kotthoff, and J. Vanschoren, “Automated Machine Learning: Methods, Systems, Challenges”, 1st ed. 2019 edition. Springer, 2019.