anomalydetection Documentation

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Warning: Anomaly Detection Framework is under an early development phase. API, architecture and implementations could suffer important changes. For this, Bluekiri do not offer any type of warranty. Use at your **own responsibility**.

CHAPTER 1

Status

CHAPTER 2

Overview

This project born from the need of detect anomalies on multiple and completely different signals, and react to it rapidly. To achieve this, Bluekiri decided to implement its own system to manage multiple signals at the same time in a easy and scalable way.

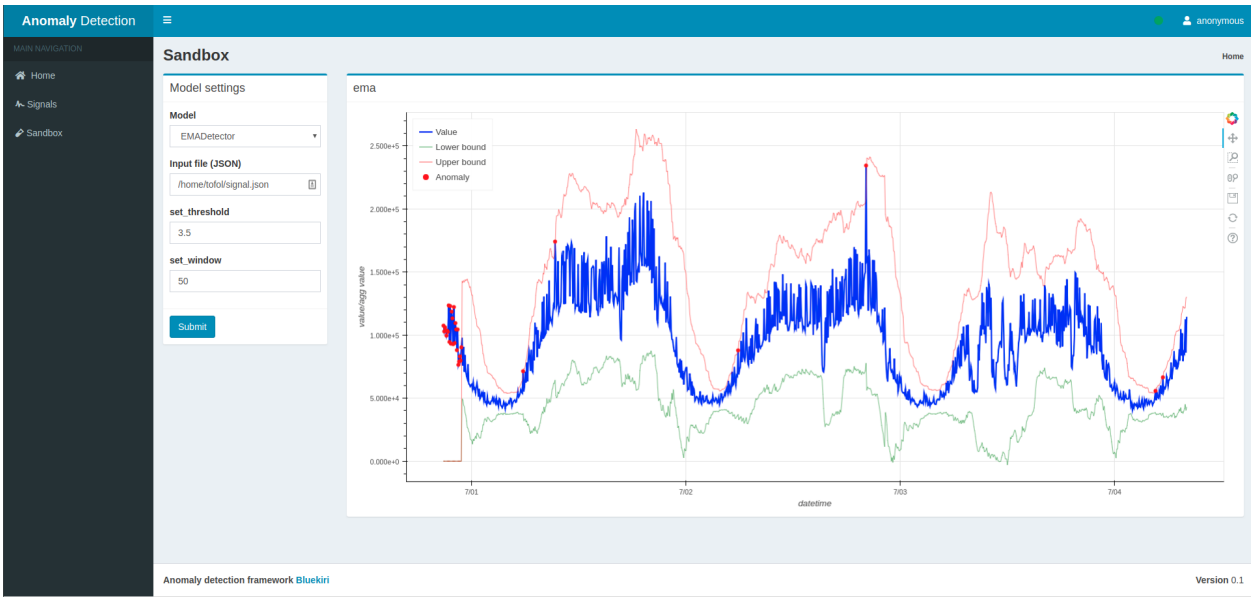
This project is not focused on Machine Learning models, but in an effective Framework to put those models in production.

CHAPTER 3

Content

3.1 Features

- It has an abstraction layer to implement engines, streaming sources and sinks, repository sources and sinks.
- It supports Kafka and PubSub by default.
- It has a default implementation for that supports tumbling window aggregation on Spark, on Kafka and PubSub sources using an specific JSON schema messages.
- Configuration file in YAML format.
- It also includes a dashboard to visualize the signal anomalies and play with signals in a sandbox to try models, tune parameters an see which parameters fits better into your signal.



Note: The Sandbox is limited to use the included message handlers and models only. Custom models will be available to use after we implement the plugin system.

3.1.1 Project

3.1.1.1 Contributors

3.1.1.2 Resources/Links

TODO

3.1.1.3 Roadmap

TODO

3.1.2 License

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<https://www.gnu.org/licenses/>.
```

3.1.3 Getting started

3.1.3.1 Install

The installation is quick and simple using pip.

```
# Anomaly Detection Framework needs a home directory to read settings from.
# In case is not provided, $HOME/anomdec will be used
export ANOMDEC_HOME=~/anomdec

# Install from pypi using pip
pip install anomalydetection
```

3.1.3.2 Sandbox

After installation, you can start a dashboard instance and play with the sandbox, there is no configuration required to do this.

```
# Start a dashboard to play with sandbox
anomdec dashboard
```

You will get an output similar to this one.

```
2018-07-09 12:37:51,930 - anomalydetection.anomdec.Anomdec:35 - INFO - Starting␣
↪anomdec
2018-07-09 12:37:51,930 - anomalydetection.anomdec.Anomdec:38 - INFO - Run dashboard
2018-07-09 12:37:51,933 - anomalydetection.common.config.Config:50 - WARNING - Cannot␣
↪load configuration.
[Errno 2] No such file or directory: '~/anomdec/anomdec.yml'
```

Note: Ignore the Config `WARNING` log if you are following this *Getting started* guide. This is because we have not configured any signal to process yet.

3.1.3.3 Devel mode

You can also run a devel mode. For this, you need to deploy a docker-compose.yml file. This will deploy an Apache Kafka, Apache Zookeeper and a Google PubSub emulator. The *devel mode* processes a random signals that are randomly generated by itself.

```
# Export kafka advertise hostname
export KAFKA_ADVERTISED_HOST_NAME=localhost

# Download docker-compose.yml file
curl -o docker-compose.yml https://raw.githubusercontent.com/bluekiri/
↪anomalydetection/master/docker-compose.yml

# Start docker enviroment
docker-compose up

# In another terminal, start the devel mode
anomdec devel
```

You should see how messages are pushed to Kafka and PubSub backends to `stdout`.

```
- anomalydetection.anomdec.Anomdec:35 - INFO - Starting anomdec
- anomalydetection.anomdec.Anomdec:53 - INFO - Creating configuration for DEVEL MODE
- anomalydetection.anomdec.Anomdec:57 - INFO - Run dashboard, backend and producer
...
- anomalydetection.backend.stream.pubsub.PubSubStreamConsumer:70 - DEBUG - Message␣
↪received: {"application": "devel0", "ts": "2018-07-09 13:00:29.886520", "value": 1}
- anomalydetection.backend.stream.pubsub.PubSubStreamConsumer:70 - DEBUG - Message␣
↪received: {"application": "devel2", "ts": "2018-07-09 13:00:29.905861", "value": 3}
- anomalydetection.backend.stream.pubsub.PubSubStreamConsumer:70 - DEBUG - Message␣
↪received: {"application": "devel1", "ts": "2018-07-09 13:00:29.902405", "value": 2}
```

Open the dashboard on your browser to visualize how data is processed in real time.

3.1.4 Configuration

Configuration is statically defined in a YAML file. The application reads `anomdec.yml` from `$ANOMDEC_HOME` path. The following section describes this file structure.

3.1.4.1 streams

`Streams` is the main section of this file. It's a named list that defines how is a signal processed.

source / engine

It has two required sections, the `source` and the `engine` This is the minimal configuration to start processing signals but, at this point we are not persisting the result.

```
1  version: 1
2
3  streams:
4    - name: my_kafka_source_one
5      source:
6        type: kafka
7        params:
8          broker_servers: localhost:9092
9          input_topic: test1
10     engine:
11       type: robust
12       params:
13         window: 30
14         threshold: 0.9999
```

sink

To persist the result we need to add a `sink` configuration section. This can be a list of *sinks*.

```
1  version: 1
2
3  streams:
4    - name: my_kafka_source_one
5      source:
```

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```
      type: kafka
      params:
        broker_servers: localhost:9092
        input_topic: test1
    engine:
      type: robust
      params:
        window: 30
        threshold: 0.9999
    sink:
      - name: sqlite
        type: repository
        repository:
          type: sqlite
          params:
            database: /tmp/my_kafka_source_one.sqlite
      - name: kafka
        type: stream
        stream:
          type: kafka
          params:
            broker_servers: localhost:9092
            output_topic: test2
```

warmup

`warmup` section has two roles, the first is to be used to *warm up* the engine before starting making predictions. The second one is to make the data accessible from the dashboard to visualize it. We will define a `warmup` configuration section with one `repository` that is also used in `sink`.

```
version: 1

streams:
  - name: my_kafka_source_one
    source:
      type: kafka
      params:
        broker_servers: localhost:9092
        input_topic: test1
    engine:
      type: robust
      params:
        window: 30
        threshold: 0.9999
    sink:
      - name: sqlite
        type: repository
        repository:
          type: sqlite
          params:
            database: /tmp/my_kafka_source_one.sqlite
      - name: kafka
        type: stream
        stream:
          type: kafka
```

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```
          params:
            broker_servers: localhost:9092
            output_topic: test2
    warmup:
      - name: sqlite
        repository:
          type: sqlite
          params:
            database: /tmp/my_kafka_source_one.sqlite
```

repository

Repository section could be found in `sink` and in `warmup` sections, it defines an storage backend that is supported by *BaseSink* implementations, *RepositorySink* and *ObservableRepository* respectively.

That `sink` repository could be also used as `warmup` to *warm up* the model in case of a model that require previous data to evaluate new data. *Although it is defined as a list, only the first element will be used to warm up the model.*

```
stream:
  type: kafka
  params:
    broker_servers: localhost:9092
```

3.1.4.2 websocket

There is a `websocket` section that is used to send output `ticks` to the dashboard. This allows to update dashboard plots in realtime.

```
websocket: ws://localhost:5000/ws/
```

3.1.4.3 Example configuration file

anomdec.yml

A full example configuration. This configuration reflects a full message flow reading from a kafka broker, processing with robust detector warmed up with the same repository that persists the output.

```
version: 1

websocket: ws://localhost:5000/ws/

streams:
  - name: my_kafka_source_one
    source:
      type: kafka
      params:
        broker_servers: localhost:9092
        input_topic: test1
    engine:
      type: robust
      params:
```

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```
        window: 30
        threshold: 0.9999
    sink:
      - name: sqlite
        type: repository
        repository:
          type: sqlite
          params:
            database: /tmp/my_kafka_source_one.sqlite
      - name: kafka
        type: stream
        stream:
          type: kafka
          params:
            broker_servers: localhost:9092
            output_topic: test2
    warmup:
      - name: sqlite
        repository:
          type: sqlite
          params:
            database: /tmp/my_kafka_source_one.sqlite
```

diagram

Here it is a diagram that represents the full configuration file. We can see that the output of the engine could be *sinked* to a repository and to an streaming system to visualize and react for anomalies, and is also used to *warm up* the engine in case of restart or failure.

3.1.5 Deploy

Important: Before continue, please read the *Configuration* section, so you will need to create a configuration file to start distinct components of the framework.

3.1.5.1 Backend

Start only the backend for the given configuration. This allows you to split the configuration in small streams chunks to deploy independently to scale horizontally.

```
export ANOMDEC_HOME=~/anomdec
anomdec backend
```

```
- anomalydetection.anomdec.Anomdec:35 - INFO - Starting anomdec
- anomalydetection.anomdec.Anomdec:44 - INFO - Run backend
...
```

3.1.5.2 Dashboard

Start only the dashboard for the given configuration. Using a unique config file you are able to visualize all streams.

```
export ANOMDEC_HOME=~/anomdec
anomdec dashboard
```

```
- anomalydetection.anomdec.Anomdec:35 - INFO - Starting anomdec
- anomalydetection.anomdec.Anomdec:41 - INFO - Run dashboard
...
```

3.1.5.3 Embedded

You can start it embedded. This will create a subprocess in the dashboard instance to process the streams.

```
export ANOMDEC_HOME=~/anomdec
anomdec
```

```
- anomalydetection.anomdec.Anomdec:35 - INFO - Starting anomdec
- anomalydetection.anomdec.Anomdec:38 - INFO - Run dashboard/backend embedded
...
```

3.1.6 Plugins

Anomaly Detection Framework is extensible by a plugin system. Plugin files must be placed in `$ANOMDEC_HOME/plugins` and are supported by the configuration parser of `anomdec.yml` file.

3.1.6.1 Interface

To create a plugin you will need to implement the class `Plugin`. You can implement any *core-around* component, so you can extend functionality as much as you want.

```
class Plugin(object):

    name = None
    # A class in a list derived from BaseConsumerBuilder
    stream_consumer_builders = []
    # A class in a list derived from BaseStreamConsumer
    stream_consumers = []
    # A class in a list derived from BaseProducerBuilder
    stream_producer_builders = []
    # A class in a list derived from BaseStreamProducer
    stream_producers = []
    # A class in a list derived from BaseEngineBuilder
    engine_builders = []
    # A class in a list derived from BaseEngine
    engines = []
    # A class in a list derived from BaseRepositoryBuilder
    repository_builders = []
    # A class in a list derived from BaseRepository
    repositories = []
    # A class in a list derived from BaseMessageHandler
    message_handlers = []
```

3.1.6.2 Example

Image you want to implement a new source, so you need to implement the *Builder* `BaseConsumerBuilder` and the *Consumer* `BaseStreamConsumer`. This consumer will read messages from a *socket*.

```
from anomalydetection.backend.core.plugins import Plugin

# Needs to be implemented
class SocketConsumer(BaseStreamConsumer):

    def __init__(self, hostname, port):
        pass

# This builder is fully implemented, note that the attrs has its own
# setter in the form of ``set_<attrname>``
class SocketConsumerBuilder(BaseConsumerBuilder):

    def __init__(self, hostname, port):
        self.set_hostname(hostname)
        self.set_port(port)

    def set_hostname(self, hostname):
        self.hostname = str(hostname)
        return self

    def set_port(self, port):
        self.port = int(port)
        return self

    def build():
        return SocketConsumer(**vars(self).copy())

class SocketsPlugin(Plugin):
    name = "socket"
    stream_consumer_builders = [SocketConsumerBuilder]
    stream_consumers = [SocketConsumer]
```

3.1.6.3 Use in anomdec.yml

The plugin system is fully supported by config parser using the plugin name in `type` sections. And params to the builder are also supported by `params` sections. Here is an example `anomdec.yml` file using this plugin.

```
version: 1

streams:

  - name: test
    source:
      type: socket
      params:
        hostname: localhost
        port: 8080
```

3.1.7 API Reference

3.1.7.1 anomalydetection

Anomaly Detection Framework is composed by 3 modules

3.1.7.2 anomalydetection.common

This module contains common components of the framework.

3.1.7.3 anomalydetection.backend

This module contains the core of the anomaly detection framework implementation.

backend.core

backend.core.plugins

backend.core.config

backend.entities

class anomalydetection.backend.entities.**BaseMessageHandler**

Bases: typing.Generic

Base message handler

classmethod extract_extra(*message*)

Extract extra data from the parsed message

Parameters **message** (~*T*) – parsed message

Return type dict

Returns a dict of extra values

classmethod extract_key(*message*)

Extracts the key of the message, this value is used to group messages

Parameters **message** (~*T*) – parsed message

Return type str

Returns word

classmethod extract_ts(*message*)

Extract the datetime of the message

Parameters **message** (~*T*) – parsed message

Return type datetime

Returns a datetime object

classmethod extract_value(*message*)

Extracts the value of the message, this value is that is given to make the prediction

Parameters **message** (~*T*) – parsed message

Return type float

Returns a float value

classmethod parse_message(*message*)
Parse or transform an input message and returns it

Parameters **message** (Any) – message serialized in a string

Return type ~T

Returns parsed message

classmethod validate_message(*message*)
Validates a message

Parameters **message** (*~T*) – validates if a message is valid or not

Return type bool

Returns True if is valid, False if is not

class anomalydetection.backend.entities.input_message.**InputMessage**(*application*, *value*, *ts*)
Bases: object

This is the parser of a json message

Parameters

- **application** (str) – application
- **value** (float) – value
- **ts** (Any) – datetime or current time stamp string in ISO 8601

to_dict()

to_json()

class anomalydetection.backend.entities.input_message.**InputMessageHandler**
Bases: *anomalydetection.backend.entities.BaseMessageHandler*

classmethod extract_extra(*message*)
Extract extra data from the parsed message

Parameters **message** (*~T*) – parsed message

Return type dict

Returns a dict of extra values

classmethod extract_key(*message*)
Extracts the key of the message, this value is used to group messages

Parameters **message** (*InputMessage*) – parsed message

Return type str

Returns word

classmethod extract_ts(*message*)
Extract the datetime of the message

Parameters **message** (*~T*) – parsed message

Return type datetime

Returns a datetime object

classmethod extract_value(*message*)
Extracts the value of the message, this value is that is given to make the prediction

Parameters **message** (*InputMessage*) – parsed message

Return type float

Returns a float value

classmethod parse_message(*message*)
Parse or transform an input message and returns it

Parameters **message** (*InputMessage*) – message serialized in a string

Return type *InputMessage*

Returns parsed message

classmethod validate_message(*message*)
Validates a message

Parameters **message** (*InputMessage*) – validates if a message is valid or not

Return type bool

Returns True if is valid, False if is not

class anomalydetection.backend.entities.output_message.**AnomalyResult**(*value_lower_limit*, *value_upper_limit*, *anomaly_probability*, *is_anomaly*)

Bases: object

AnomalyResult description

Variables

- **value_lower_limit** – lower bound limit
- **value_upper_limit** – upper bound limit
- **anomaly_probability** – probability of being anomalous
- **is_anomaly** – if its anomalous or not

AnomalyResults constructor

Parameters

- **value_lower_limit** (float) – lower bound limit
- **value_upper_limit** (float) – upper bound limit
- **anomaly_probability** (float) – probability of being anomalous
- **is_anomaly** (bool) – if its anomalous or not

to_dict()

class anomalydetection.backend.entities.output_message.**OutputMessage**(*application*, *anomaly_results*, *agg_window_millis=0*, *agg_function=<AggregationFu 'none'>*, *agg_value=0*, *ts=datetime.datetime(2018, 7, 11, 14, 28, 33, 542179)*)

Bases: object

OutputMessage class description

Variables

- **application** – application name
- **anomaly_results** – anomaly results
- **agg_window_millis** – aggregation window in milliseconds
- **agg_function** – aggregation function
- **agg_value** – the value after aggregation
- **ts** – timestamp

OutputMessage class constructor

Parameters

- **application** (*str*) – application name
- **anomaly_results** (*AnomalyResult*) – anomaly results
- **agg_window_millis** (*int*) – aggregation window in milliseconds
- **agg_function** (*AggregationFunction*) – aggregation function
- **agg_value** (*float*) – the value after aggregation
- **ts** (*<module 'datetime' from '/usr/lib/python3.5/datetime.py'>*) – timestamp

to_dict(*ts2str=False*)

to_input()

to_plain_dict()

class anomalydetection.backend.entities.output_message.**OutputMessageHandler**

Bases: *anomalydetection.backend.entities.BaseMessageHandler*

classmethod extract_extra(*message*)

Extract extra data from the parsed message

Parameters **message** (*InputMessage*) – parsed message

Return type dict

Returns a dict of extra values

classmethod extract_key(*message*)

Extracts the key of the message, this value is used to group messages

Parameters **message** (*InputMessage*) – parsed message

Return type str

Returns word

classmethod extract_ts(*message*)
Extract the datetime of the message

Parameters **message** (*~T*) – parsed message

Return type datetime

Returns a datetime object

classmethod extract_value(*message*)
Extracts the value of the message, this value is that is given to make the prediction

Parameters **message** (*InputMessage*) – parsed message

Return type float

Returns a float value

classmethod parse_message(*message*)
Parse or transform an input message and returns it

Parameters **message** (*OutputMessage*) – message serialized in a string

Return type *InputMessage*

Returns parsed message

classmethod validate_message(*message*)
Validates a message

Parameters **message** (*InputMessage*) – validates if a message is valid or not

Return type bool

Returns True if is valid, False if is not

There is a default JSON format message handler implementation ready to use

backend.engine

class anomalydetection.backend.engine.builder.**BaseEngineBuilder**
Bases: object

BaseBuilder, implement this to create Engine Builders.

build()
Build the engine

Return type *BaseEngine*

Returns A BaseEngine implementation instance.

set(*name*, *value*)

class anomalydetection.backend.engine.builder.**CADDetectorBuilder**(*min_value=-9223372036854775807*, *max_value=9223372036854775807*, *threshold=0.95*, *rest_period=30*, *max_left_semi_contexts_length=8*, *max_active_neurons_num=16*, *num_norm_value_bits=3*)

Bases: *anomalydetection.backend.engine.builder.BaseEngineBuilder*

build()

Build the engine

Return type *CADDetector*

Returns A BaseEngine implementation instance.

set(*name*, *value*)

set_max_active_neurons_num(*max_active_neurons_num*)

set_max_left_semi_contexts_length(*max_left_semi_contexts_length*)

set_max_value(*value*)

set_min_value(*value*)

set_num_norm_value_bits(*num_norm_value_bits*)

set_rest_period(*rest_period*)

set_threshold(*threshold*)

type = 'cad'

class anomalydetection.backend.engine.builder.**EMADetectorBuilder**(*window=100*, *threshold=0.9999*)

Bases: *anomalydetection.backend.engine.builder.BaseEngineBuilder*

build()

Build the engine

Return type *EMADetector*

Returns A BaseEngine implementation instance.

set(*name*, *value*)

set_threshold(*threshold*)

set_window(*window*)

type = 'ema'

class anomalydetection.backend.engine.builder.**EngineBuilderFactory**

Bases: object

engines = {'cad': {'key': 'cad', 'name': 'CADDetector'}, 'ema': {'key': 'ema', 'na

static get(*name*)

Return type *BaseEngineBuilder*

static get_cad()

Return type *CADDetectorBuilder*

static get_ema()

Return type *EMADetectorBuilder*

static get_plugin(*name*)

Return type *BaseEngineBuilder*

static get_robust()

Return type *RobustDetectorBuilder*

classmethod register_engine(*key*, *class_name*)

class anomalydetection.backend.engine.builder.**RobustDetectorBuilder**(*window=100*, *threshold=0.9999*)

Bases: *anomalydetection.backend.engine.builder.BaseEngineBuilder*

build()

Build the engine

Return type *RobustDetector*

Returns A BaseEngine implementation instance.

set(*name*, *value*)

set_threshold(*threshold*)

set_window(*window*)

type = 'robust'

class anomalydetection.backend.engine.**BaseEngine**

Bases: object

Base class for any Engine implementation.

predict(*value*, ***kwargs*)

Predict if the given value is anomalous.

Parameters

- **value** (float) – value to predict
- **kwargs** – extra data to make the prediction

Return type *AnomalyResult*

Returns anomaly result

class anomalydetection.backend.engine.cad_engine.**CADDetector**(*min_value=-9223372036854775807*, *max_value=9223372036854775807*, *threshold=0.95*, *rest_period=30*, *max_left_semi_contexts_length=8*, *max_active_neurons_num=16*, *num_norm_value_bits=3*)

Bases: *anomalydetection.backend.engine.BaseEngine*

Contextual Anomaly Detector - Open Source Edition https://github.com/smirmik/CAD

get_anomaly_score(*input_data*)

predict(*value*, ***kwargs*)
Predict if the given value is anomalous.

Parameters

- **value** (float) – value to predict
- **kwargs** – extra data to make the prediction

Return type *AnomalyResult*

Returns anomaly result

step(*inp_facts*)

class anomalydetection.backend.engine.cad_engine.**ContextOperator**(*max_left_semi_cntx_len*)
Bases: object

context_crosser(*left_or_right*, *facts_list*, *new_context_flag=False*, *potential_new_contexts=[]*)

get_context_by_facts(*new_contexts_list*, *zero_level=0*)

update_contexts_and_get_active(*new_context_flag*)

class anomalydetection.backend.engine.ema_engine.**EMADetector**(*window=100*, *threshold=2.0*)
Bases: *anomalydetection.backend.engine.BaseEngine*

EMADetector constructor :param window: window of samples to work with :param threshold: threshold for confidence

predict(*value*, ***kwargs*)
Predict if the given value is anomalous.

Parameters

- **value** (float) – value to predict
- **kwargs** – extra data to make the prediction

Return type *AnomalyResult*

Returns anomaly result

class anomalydetection.backend.engine.robust_z_engine.**RobustDetector**(*window=100*, *threshold=0.9999*)
Bases: *anomalydetection.backend.engine.BaseEngine*, anomalydetection.common.logging.LoggingMixin

Anomaly detection engine based in robust statistics, median and median absolute deviation.

Parameters

- **window** – window of samples to work with
- **threshold** – threshold for confidence

logger
Logger object.

Returns a configured logger object

predict(*value*, ***kwargs*)
Predict if the given value is anomalous.

Parameters

- **value** (*float*) – value to predict
- **kwargs** – extra data to make the prediction

Return type *AnomalyResult*

Returns anomaly result

backend.interactor

class anomalydetection.backend.interactor.**BaseEngineInteractor**(*engine_builder*, *message_handler*)

Bases: object

BaseEngineInteractor is responsible to hold the engine builder and the message handler. It's also responsible for build engines for each application

BaseEngineInteractor constructor

Parameters

- **engine_builder** (*BaseEngineBuilder*) – engine builder
- **message_handler** (*BaseMessageHandler*[~T]) – message handler

get_engine(*application*)

Return the engine for the application in a thread safe way

Parameters **application** (*str*) – application name

Returns its engine

class anomalydetection.backend.interactor.batch_engine.**BatchEngineInteractor**(*batch*, *engine_builder*, *message_handler*)

Bases: *anomalydetection.backend.interactor.BaseEngineInteractor*, anomalydetection.common.logging.LoggingMixin

BatchEngineInteractor is an implementation for batch process an Observable

BatchEngineInteractor constructor

Parameters

- **batch** (*BaseObservable*) – an observable
- **engine_builder** (*BaseEngineBuilder*) – an engine builder
- **message_handler** (*BaseMessageHandler*[~T]) – a message handler

get_engine(*application*)

Return the engine for the application in a thread safe way

Parameters **application** (*str*) – application name

Returns its engine

logger

Logger object.

Returns a configured logger object

map_with_engine(*input_message*)

Return type *OutputMessage*

process()

Return type Observable

backend.repository

class anomalydetection.backend.repository.**BaseObservableRepository**(*repository*)

Bases: *anomalydetection.backend.stream.BaseObservable*

Use a repository as an Observable

BaseObservableRepository constructor

Parameters **repository** (*BaseRepository*) – a repository

get_max()

get_min()

get_observable()

Return type Observable

map(*x*)

Map items in observable.

Parameters **x** (Any) – input item

Return type Any

Returns output item

class anomalydetection.backend.repository.**BaseRepository**(*conn*)

Bases: object

fetch(*application*, *from_ts*, *to_ts*)

Fetch data from repository, should return ordered data

Parameters

- **application** – application name
- **from_ts** – from timestamp
- **to_ts** – to timestamp

Return type Iterable[+T_co]

Returns an iterable

get_applications()

Return a list of distinct applications contained in the repository.

Return type List[str]

Returns a list of application names

initialize()

Initialize the repository

insert(*message*)

Insert an OutputMessage into the repository

Parameters **message** (*OutputMessage*) – an output message

Return type None

map(*item*)
Map function to map elements returned by fetch method to OutputMessage

Parameters **item** (*Any*) – an element in fetch iterable

Return type *OutputMessage*

Returns an OutputMessage

backend.repository.builder

class anomalydetection.backend.repository.builder.**BaseRepositoryBuilder**
Bases: object

BaseBuilder, implement this to create Repository Builders.

build()
Build a repository

Return type *BaseRepository*

Returns A BaseRepository implementation instance.

set(*name*, *value*)

class anomalydetection.backend.repository.builder.**RepositoryBuilderFactory**
Bases: object

static get(*name*)

Return type *BaseRepositoryBuilder*

static get_plugin(*name*)

Return type *BaseRepositoryBuilder*

static get_sqlite()

Return type *SQLiteBuilder*

class anomalydetection.backend.repository.builder.**SQLiteBuilder**(*database=None*)
Bases: *anomalydetection.backend.repository.builder.BaseRepositoryBuilder*

build()
Build a repository

Return type *BaseRepository*

Returns A BaseRepository implementation instance.

set(*name*, *value*)

set_database(*database*)

backend.repository.observable

class anomalydetection.backend.repository.observable.**ObservableRepository**(*repository*, *application=None*, *from_ts=None*, *to_ts=None*)

Bases: *anomalydetection.backend.repository.BaseObservableRepository*

Creates ObservableRepository that is capable to act as an observable

Parameters

- **repository** (*BaseRepository*) – the repository
- **application** – application name
- **from_ts** – from timestamp
- **to_ts** – to timestamp

get_max()

get_min()

get_observable()

Return type Observable

map(*x*)

Map items in observable.

Parameters **x** (Any) – input item

Return type Any

Returns output item

backend.repository.sqlite

class anomalydetection.backend.repository.sqlite.**SQLiteRepository**(*database*)

Bases: *anomalydetection.backend.repository.BaseRepository*

SQLiteRepository constructor

Parameters **database** (str) – database path

fetch(*application*, *from_ts*, *to_ts*)

Fetch data from repository, should return ordered data

Parameters

- **application** – application name
- **from_ts** – from timestamp
- **to_ts** – to timestamp

Return type Iterable[Row]

Returns an iterable

get_applications()
Return a list of distinct applications contained in the repository.

Returns a list of application names

initialize()
Initialize the repository

insert(*message*)
Insert an OutputMessage into the repository

Parameters **message** (*OutputMessage*) – an output message

map(*item*)
Map function to map elements returned by fetch method to OutputMessage

Parameters **item** (Row) – an element in fetch iterable

Return type *OutputMessage*

Returns an OutputMessage

backend.sink

class anomalydetection.backend.sink.**BaseSink**
Bases: rx.core.py3.observer.Observer

BaseSink, implement this to create Sinks

as_observer()
Hides the identity of an observer.

Returns an observer that hides the identity of the specified observer.

checked()
Checks access to the observer for grammar violations. This includes checking for multiple OnError or OnCompleted calls, as well as reentrancy in any of the observer methods. If a violation is detected, an Error is thrown from the offending observer method call.

Returns an observer that checks callbacks invocations against the observer grammar and, if the checks pass, forwards those to the specified observer.

classmethod from_notifier(*handler*)
Creates an observer from a notification callback.

Keyword arguments: :param handler: Action that handles a notification.

Returns The observer object that invokes the specified handler using a

notification corresponding to each message it receives. :rtype: Observer

on_completed()

on_error(*error*)

on_next(*value*)

to_notifier()
Creates a notification callback from an observer.

Returns the action that forwards its input notification to the underlying observer.

backend.sink.repository

class anomalydetection.backend.sink.repository.**RepositorySink**(*repository*)
Bases: *anomalydetection.backend.sink.BaseSink*, anomalydetection.common.logging.LoggingMixin

Creates a RepositorySink that is capable to sink OutputMessages into the given repository

Parameters **repository** (*BaseRepository*) – a repository

as_observer()
Hides the identity of an observer.

Returns an observer that hides the identity of the specified observer.

checked()
Checks access to the observer for grammar violations. This includes checking for multiple OnError or OnCompleted calls, as well as reentrancy in any of the observer methods. If a violation is detected, an Error is thrown from the offending observer method call.

Returns an observer that checks callbacks invocations against the observer grammar and, if the checks pass, forwards those to the specified observer.

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Creates an observer from a notification callback.

Keyword arguments: :param handler: Action that handles a notification.

Returns The observer object that invokes the specified handler using a

notification corresponding to each message it receives. :rtype: Observer

logger
Logger object.

Returns a configured logger object

on_completed()

on_error(*error*)

on_next(*value*)

to_notifier()
Creates a notification callback from an observer.

Returns the action that forwards its input notification to the underlying observer.

backend.sink.stream

class anomalydetection.backend.sink.stream.**StreamSink**(*stream_producer*)
Bases: *anomalydetection.backend.sink.BaseSink*, anomalydetection.common.logging.LoggingMixin

Creates a StreamSink that is capable to sink OutputMessages into the stream producer

Parameters **stream_producer** (*BaseStreamProducer*) – an stream producer

as_observer()
Hides the identity of an observer.

Returns an observer that hides the identity of the specified observer.

checked()
Checks access to the observer for grammar violations. This includes checking for multiple OnError or OnCompleted calls, as well as reentrancy in any of the observer methods. If a violation is detected, an Error is thrown from the offending observer method call.

Returns an observer that checks callbacks invocations against the observer grammar and, if the checks pass, forwards those to the specified observer.

classmethod from_notifier(*handler*)
Creates an observer from a notification callback.

Keyword arguments: :param handler: Action that handles a notification.

Returns The observer object that invokes the specified handler using a

notification corresponding to each message it receives. :rtype: Observer

logger
Logger object.

Returns a configured logger object

on_completed()

on_error(*error*)

on_next(*value*)

to_notifier()
Creates a notification callback from an observer.

Returns the action that forwards its input notification to the underlying observer.

backend.sink.websocket

class anomalydetection.backend.sink.websocket.**WebSocketSink**(*name*, *url*)
Bases: *anomalydetection.backend.sink.BaseSink*, anomalydetection.common.logging.LoggingMixin

Implementation to Sink OutputMessage stream to a WebSocket

Parameters

- **name** (str) – name
- **url** (str) – websocket url

as_observer()
Hides the identity of an observer.

Returns an observer that hides the identity of the specified observer.

checked()
Checks access to the observer for grammar violations. This includes checking for multiple OnError or OnCompleted calls, as well as reentrancy in any of the observer methods. If a violation is detected, an Error is thrown from the offending observer method call.

Returns an observer that checks callbacks invocations against the observer grammar and, if the checks pass, forwards those to the specified observer.

classmethod from_notifier(*handler*)
Creates an observer from a notification callback.

Keyword arguments: :param handler: Action that handles a notification.

Returns The observer object that invokes the specified handler using a

notification corresponding to each message it receives. :rtype: Observer

logger
Logger object.

Returns a configured logger object

on_completed()

on_error(*error*)

on_next(*value*)

to_notifier()
Creates a notification callback from an observer.

Returns the action that forwards its input notification to the underlying observer.

backend.stream

class anomalydetection.backend.stream.**BaseObservable**
Bases: object

get_observable()

Return type Observable

map(*x*)
Map items in observable.

Parameters **x** (Any) – input item

Return type Any

Returns output item

class anomalydetection.backend.stream.**BaseStreamAggregation**(*agg_function=<AggregationFunction.NONE: 'none'>*, *agg_window_millis=0*)
Bases: object

BaseStreamAggregation class

Parameters

- **agg_function** (*AggregationFunction*) – aggregation function
- **agg_window_millis** (int) – aggregation window in milliseconds

class anomalydetection.backend.stream.**BaseStreamConsumer**
Bases: *anomalydetection.backend.stream.BaseObservable*

get_observable()

Return type Observable

map(*x*)
Map items in observable.

Parameters **x** (Any) – input item

Return type Any

Returns output item

poll()

Return type Generator

class anomalydetection.backend.stream.**BaseStreamProducer**
Bases: object

push(*message*)

Return type None

class anomalydetection.backend.stream.**FileObservable**(*file*)
Bases: *anomalydetection.backend.stream.BaseObservable*

FileObservable to transform a file lines to an Observable

Parameters **file** (str) – a path to local file

get_observable()

Return type Observable

map(*x*)
Map items in observable.

Parameters **x** (Any) – input item

Return type Any

Returns output item

backend.stream.agg

class anomalydetection.backend.stream.agg.functions.**AggregationFunction**
Bases: enum.Enum

An enumeration.

AVG = 'avg'

COUNT = 'count'

NONE = 'none'

P50 = 'percentile50'

P75 = 'percentile75'

P95 = 'percentile95'

P99 = 'percentile99'

SUM = 'sum'

backend.stream.builder

backend.stream.kafka

class anomalydetection.backend.stream.kafka.**KafkaStreamConsumer**(*broker_servers*, *input_topic*, *group_id*)
Bases: *anomalydetection.backend.stream.BaseStreamConsumer*, anomalydetection.common.logging.LoggingMixin

KafkaStreamConsumer constructor

Parameters

- **broker_servers** (str) – broker servers
- **input_topic** (str) – input topic
- **group_id** (str) – consumer group id

get_observable()

Return type Observable

logger
Logger object.

Returns a configured logger object

map(*x*)
Map items in observable.

Parameters **x** (Any) – input item

Return type Any

Returns output item

poll()

Return type Generator[+T_co, -T_contra, +V_co]

unsubscribe()

class anomalydetection.backend.stream.kafka.**KafkaStreamProducer**(*broker_servers*, *output_topic*)

Bases: *anomalydetection.backend.stream.BaseStreamProducer*, anomalydetection.common.logging.LoggingMixin

KafkaStreamProducer constructor

Parameters

- **broker_servers** (str) – broker servers
- **output_topic** (str) – topic to write to

logger
Logger object.

Returns a configured logger object

push(*message*)

Return type None

class anomalydetection.backend.stream.kafka.**SparkKafkaStreamConsumer**(*broker_servers*, *input_topic*, *group_id*, *agg_function*, *agg_window_millis*, *spark_opts={}*, *multiprocessing=True*)

Bases: *anomalydetection.backend.stream.BaseStreamConsumer*, *anomalydetection.backend.stream.BaseStreamAggregation*, anomalydetection.common.logging.LoggingMixin

SparkKafkaStreamConsumer constructor

Parameters

- **broker_servers** (str) – broker servers
- **input_topic** (str) – input topic
- **group_id** (str) – consumer group id
- **agg_function** (*AggregationFunction*) – aggregation function to apply
- **agg_window_millis** (int) – aggregation window in milliseconds
- **spark_opts** (dict) – spark options dict
- **multiprocessing** – use multiprocessing instead of threading

get_observable()

Return type Observable

logger

Logger object.

Returns a configured logger object

map(*x*)

Map items in observable.

Parameters **x** (Any) – input item

Return type Any

Returns output item

poll()

Return type Generator[+T_co, -T_contra, +V_co]

unsubscribe()

backend.stream.pubsub

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