
qirest-client

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CHAPTER 1

Synopsis

The Quantitative Imaging Profile (*QIPr*) REST client interacts with the *qipr* REST server.

API <https://qirest-client.readthedocs.org/en/latest/api/index.html>

Git <https://github.com/ohsu-qin/qirest-client>

CHAPTER 2

Installation

1. Install the `qiprofile REST` server.
2. Add `qirest-client` to your `Python` project `setup.py` `install_requires`.
3. Update your project installation to reflect the REST client dependency.
4. Start the `qiprofile REST` server.

CHAPTER 3

Usage

See the [qiprofile REST Data Model](#) and API documentation.

CHAPTER 4

Development

Testing is performed with the `nose` package, which must be installed separately.

Documentation is built automatically by `ReadTheDocs` when the project is pushed to GitHub. Documentation can be generated locally as follows:

- Install `Sphinx`, if necessary.
- Run the following in the `doc` subdirectory:

```
make html
```

API Documentation

model

model Package

The qiprofile REST data model.

The model field choices are listed in the preferred display order, most common to least common.

The data capture client has the following responsibility:

- Validate the data upon input as determined by the model validation documentation.
- Resolve conflicts between data capture and the model, e.g. the default value or validation.

admin

The qiprofile administrative MongoDB data model.

```
class qirest_client.model.admin.User(*args, **values)
    Bases: mongoengine.document.Document
```

The application user.

Initialise a document or embedded document

Parameters

- **__auto_convert** – Try and will cast python objects to Object types
- **values** – A dictionary of values for the document

clinical

The qiprofile clinical Mongodb data model.

```
class qirest_client.model.clinical.Agent(*args, **kwargs)
    Bases: mongoengine.document.EmbeddedDocument
```

A treatment agent, e.g. drug or radiation.

```
class qirest_client.model.clinical.Biopsy(*args, **kwargs)
    Bases: qirest_client.model.common.Encounter
```

Non-therapeutic tissue extraction resulting in a pathology report.

```
class qirest_client.model.clinical.BreastGeneticExpression(*args, **kwargs)
    Bases: qirest_client.model.common.Outcome
```

The breast patient genetic expression results.

```
class qirest_client.model.clinical.BreastNormalizedAssay(*args, **kwargs)
    Bases: mongoengine.document.EmbeddedDocument
```

The Breast genomics panel normalized to reference genes.

```
class qirest_client.model.clinical.BreastNormalizedAssayField(min_value=None,
                                                                max_value=None,
                                                                **kwargs)
    Bases: mongoengine.fields.IntField
```

The normalized Breast genomics result in the inclusive range [0, 15].

```
class qirest_client.model.clinical.BreastPathology(*args, **kwargs)
    Bases: qirest_client.model.clinical.TumorPathology
```

The breast patient pathology summary.

```
rcb_class(rcb_index)
    Returns the RCB class per the cut-offs defined in JCO 25:28 4414-4422.
```

Parameters **rcb_index** – the *rcb_index()* value

```
rcb_index()
    Returns the RCB index per JCO 25:28 4414-4422.
```

```
class qirest_client.model.clinical.BreastSurgery(*args, **kwargs)
    Bases: qirest_client.model.clinical.Surgery
```

Breast tumor extraction.

```
class qirest_client.model.clinical.Dosage(*args, **kwargs)
    Bases: mongoengine.document.EmbeddedDocument
```

The agent dosage.

```
class qirest_client.model.clinical.Evaluation (*args, **kwargs)
    Bases: mongoengine.document.EmbeddedDocument
```

The patient evaluation holds outcomes.

```
class qirest_client.model.clinical.FNCLCCGrade (*args, **kwargs)
    Bases: qirest_client.model.clinical.Grade
```

The **FNCLCC** sarcoma tumor grade.

```
class qirest_client.model.clinical.Grade (*args, **kwargs)
    Bases: mongoengine.document.EmbeddedDocument
```

The abstract tumor grade superclass, specialized for each tumor type.

```
class qirest_client.model.clinical.HormoneReceptorStatus (*args, **kwargs)
    Bases: qirest_client.model.common.Outcome
```

The patient estrogen/progesterone hormone receptor status.

```
class qirest_client.model.clinical.ModifiedBloomRichardsonGrade (*args, **kwargs)
    Bases: qirest_client.model.clinical.Grade
```

The **Modified Bloom Richardson** (a.k.a. Nottingham) breast tumor grade.

```
class qirest_client.model.clinical.NecrosisPercent (*args, **kwargs)
    Bases: qirest_client.model.common.Outcome
```

The necrosis percent value or range.

```
class qirest_client.model.clinical.NecrosisPercentRange (*args, **kwargs)
    Bases: qirest_client.model.clinical.NecrosisPercent
```

The necrosis percent range.

Note it is recommended, although not required, that the percent range is a decile range, e.g. [20-30].

Note A range which spans 50%, e.g. [40-60], results in a `necrosis_percent_as_score()` `ValidationError`.

```
class Bound (*args, **kwargs)
    Bases: mongoengine.document.EmbeddedDocument
```

Necrosis percent upper or lower bound abstract class. The subclass is responsible for adding the inclusive field.

```
class NecrosisPercentRange.LowerBound (*args, **kwargs)
    Bases: qirest_client.model.clinical.Bound
```

Necrosis percent lower bound.

```
class NecrosisPercentRange.UpperBound (*args, **kwargs)
    Bases: qirest_client.model.clinical.Bound
```

Necrosis percent upper bound.

```
class qirest_client.model.clinical.NecrosisPercentValue (*args, **kwargs)
    Bases: qirest_client.model.clinical.NecrosisPercent
```

The necrosis percent absolute value.

```
class qirest_client.model.clinical.PathologyReport (*args, **kwargs)
    Bases: qirest_client.model.clinical.Evaluation
```

The patient pathology report findings.

class `qirest_client.model.clinical.ResidualCancerBurden(*args, **kwargs)`
Bases: `mongoengine.document.EmbeddedDocument`

The residual cancer burden after neoadjuvant treatment.

class `qirest_client.model.clinical.SarcomaPathology(*args, **kwargs)`
Bases: `qirest_client.model.clinical.TumorPathology`

The sarcoma patient pathology summary.

class `qirest_client.model.clinical.Surgery(*args, **kwargs)`
Bases: `qirest_client.model.common.Encounter`

Therapeutic tissue extraction which usually results in a pathology report.

class `qirest_client.model.clinical.TNM(*args, **kwargs)`
Bases: `qirest_client.model.common.Outcome`

The TNM tumor staging. The TNM fields are as follows:

- size - primary tumor size (T)
- lymph_status - regional lymph nodes (N)
- metastasis - distant metastasis (M)
- grade - tumor grade (G)
- serum_tumor_markers (S)
- resection_boundaries (R)
- lymphatic_vessel_invasion (L)
- vein_invasion (V)

The size is an aggregate Size field. See <http://www.cancer.gov/cancertopics/factsheet/detection/staging> for an overview. See http://en.wikipedia.org/wiki/TNM_staging_system and <http://cancerstaging.blogspot.com/> for the value definition.

Note The size and lymph_status choices can be further constrained by tumor type. Since `TNM` is a generic class, these constraints are not enforced in this `TNM` class. Rather, the REST client is responsible for enforcing additional choice constraints. The `TNM.lymph_status_choices()` helper method can be used for tumor type specific choices. See `TNM.Size`` for a discussion of the size constraints.

class `Size(*args, **kwargs)`
Bases: `mongoengine.document.EmbeddedDocument`

The TNM primary tumor size field.

Note The size score choices can be further constrained by tumor type. For example, the sarcoma tumor_size choices are 0, 1 or 2 and suffix choices are a or b. See `TNM` for a discussion of choice constraints. The `TNM.Size.tumor_size_choices()` and `TNM.Size.suffix_choices()` helper methods can be used for tumor type specific choices.

clean()

Performs document-level validation.

Raises `ValidationError` – if the `in_situ` flag is set but there is a tumor_size or suffix field

classmethod `parse(klass, value)`

Parses the given string into a new `Size`. The size must match the `SIZE_REGEX` regular expression.

Parameters `value` – the input string

Returns the new `Size` object

Raises `ValidationError` – if the size value string does not match `SIZE_REGEX`

static `suffix_choices` (*tumor_type=None*)
Parameters `tumor_type` – the optional tumor type, e.g. Breast
Returns the suffix choices for the given type

static `tumor_size_choices` (*tumor_type=None*)
Parameters `tumor_type` – the optional tumor type, e.g. Breast
Returns the tumor_size choices for the given type

static `TNM.lymph_status_choices` (*tumor_type=None*)
Parameters `tumor_type` – the optional tumor type, e.g. Breast
Returns the lymph_status choices for the given type

class `qirest_client.model.clinical.Treatment` (*args, **kwargs)
Bases: `mongoengine.document.EmbeddedDocument`

The patient therapy, e.g. adjuvant. Treatment is one of the `Treatment.TYPE_CHOICES` types, and occurs over a period of time. The treatment consists of dosages, which may be pharmacological or radiological.

class `qirest_client.model.clinical.TumorLocation` (*args, **kwargs)
Bases: `mongoengine.document.EmbeddedDocument`

The tumor body part and directional orientation.

class `qirest_client.model.clinical.TumorPathology` (*args, **kwargs)
Bases: `mongoengine.document.EmbeddedDocument`

The tumor-specific pathology.

`qirest_client.model.clinical.necrosis_percent_as_score` (*necrosis_percent*)
Calculates the necrosis score from the necrosis percent according to the *Stanford Synovial Sarcoma Guideline* <http://surgpathcriteria.stanford.edu/softmisc/synovial_sarcoma/grading.html> as follows: * If the percent is None, then None * Otherwise, if the percent is 0, then 0 * Otherwise, if the percent is less than 50, then 1 * Otherwise, 2

Parameters `necrosis_percent` – the integer percent, *NecrosisPercentValue* or *NecrosisPercentRange*

Returns the necrosis score

Raises `ValidationError` – if the percent is a range that spans 50%

imaging

The qiprofile imaging MongoDB data model.

class `qirest_client.model.imaging.Image` (*args, **kwargs)
Bases: `mongoengine.document.EmbeddedDocument`

The image file encapsulation.

class `qirest_client.model.imaging.ImageSequence` (*args, **kwargs)
Bases: `qirest_client.model.common.Outcome`

The Scan or Registration.

class `qirest_client.model.imaging.LabelMap` (*args, **kwargs)
Bases: `qirest_client.model.imaging.Image`

A label map with an optional associated color lookup table.

```
class qirest_client.model.imaging.Modeling(*args, **kwargs)
    Bases: qirest_client.model.common.Outcome
```

The pharmacokinetic modeling run on an image sequence.

```
class ParameterResult(*args, **kwargs)
    Bases: mongoengine.document.EmbeddedDocument
```

The output for a given modeling run result parameter.

```
class Modeling.Source(*args, **kwargs)
    Bases: mongoengine.document.EmbeddedDocument
```

This Modeling.Source embedded class works around the following mongoengine limitation:

- mongoengine does not allow heterogeneous collections, i.e. a domain model Document subclass cannot have subclasses. Furthermore, the domain model Document class cannot be an inner class.

Consequently, the Modeling.source field cannot represent an abstract superclass with subclasses RegistrationSource and ScanSource. The work-around is to introduce this Source embedded document disambiguation by creating a disjunction object that can either hold a *scan* reference or a *registration* reference.

```
class qirest_client.model.imaging.MultiImageResource(*args, **kwargs)
    Bases: qirest_client.model.imaging.Resource
```

A resource with several files.

```
class qirest_client.model.imaging.Point(*args, **kwargs)
    Bases: mongoengine.document.EmbeddedDocument
```

The 3D point in the volume voxel space.

```
class qirest_client.model.imaging.Protocol(*args, **values)
    Bases: mongoengine.document.Document
```

The image acquisition or processing protocol abstract class.

Initialise a document or embedded document

Parameters

- **__auto_convert** – Try and will cast python objects to Object types
- **values** – A dictionary of values for the document

```
class qirest_client.model.imaging.Region(*args, **kwargs)
    Bases: mongoengine.document.EmbeddedDocument
```

The 3D region in volume voxel space.

```
class qirest_client.model.imaging.Registration(*args, **kwargs)
    Bases: qirest_client.model.imaging.ImageSequence
```

The patient image registration that results from processing a scan.

```
class qirest_client.model.imaging.Resource(*args, **kwargs)
    Bases: mongoengine.document.EmbeddedDocument
```

The image store file access abstraction.

```
class qirest_client.model.imaging.Scan(*args, **kwargs)
    Bases: qirest_client.model.imaging.ImageSequence
```

The the concrete subclass of the abstract *ImageSequence* class for scans.

```
class qirest_client.model.imaging.Session (*args, **kwargs)
    Bases: qirest_client.model.common.Encounter
```

The MR session (a.k.a. *study* in DICOM terminology).

acquisition_parameters
alias of DictField

classmethod pre_delete (sender, document, **kwargs)
Cascade delete this Session's detail.

```
class qirest_client.model.imaging.SessionDetail (*args, **values)
    Bases: mongoengine.document.Document
```

The MR session detailed content.

Initialise a document or embedded document

Parameters

- **__auto_convert** – Try and will cast python objects to Object types
- **values** – A dictionary of values for the document

```
class qirest_client.model.imaging.SingleImageResource (*args, **kwargs)
    Bases: qirest_client.model.imaging.Resource
```

A resource with one file.

subject

The qiprofile subject Mongoddb data model.

```
class qirest_client.model.subject.ImagingCollection (*args, **values)
    Bases: mongoengine.document.Document
```

The imaging collection.

Initialise a document or embedded document

Parameters

- **__auto_convert** – Try and will cast python objects to Object types
- **values** – A dictionary of values for the document

```
class qirest_client.model.subject.Project (*args, **values)
    Bases: mongoengine.document.Document
```

The imaging project.

Initialise a document or embedded document

Parameters

- **__auto_convert** – Try and will cast python objects to Object types
- **values** – A dictionary of values for the document

```
class qirest_client.model.subject.Subject (*args, **values)
    Bases: mongoengine.document.Document
```

The patient.

Initialise a document or embedded document

Parameters

- **__auto_convert** – Try and will cast python objects to Object types
- **values** – A dictionary of values for the document

add_encounter (*encounter*)

Inserts the given encounter to this *Subject* encounters list in temporal order by encounter date.

clinical_encounters

Returns the `non-qirest_client.imaging.Session` encounters

pre_delete (*sender, document, **kwargs*)

Cascade delete the subject's sessions.

sessions

Returns the `qirest_client.imaging.Session` encounters

uom

The qiprofile unit of measurement MongoDB data model.

This uom module is an advisory module for quantity display and conversion. Quantities are always stored in a canonical unit documented in the field.

class `qirest_client.model.uom.Decimal` (**args, **kwargs*)

Bases: `mongoengine.document.EmbeddedDocument`

This Decimal document class is a work-around for the broken MongoEngine DecimalField (cf. <https://github.com/MongoEngine/mongoengine/issues?q=is%3Aissue+is%3Aopen+decimal>).

Decimal has a float value and an optional precision. The default precision is determined as follows:

- If the Decimal value is initialized with a python `decimal.Decimal` or string, then the default precision is the number of decimal places expressed in that value, e.g.:

```
Decimal('1.24').precision #=> 2
Decimal(decimal.Decimal('1.4')).precision #=> 1
```

- If the Decimal value is initialized with an integer, then the default precision is zero, e.g.:

```
Decimal(1).precision #=> 0
```

__init__ (**args, **kwargs*)

canonical ()

Returns the python `decimal.Decimal` equivalent of this Decimal

class `qirest_client.model.uom.Measurement` (**args, **kwargs*)

Bases: `mongoengine.document.EmbeddedDocument`

A scientific measurement.

The measurement is a quantitative amount associated with a unit. The unit is the Unit as captured and displayed. The amount is expressed as a python Decimal in unscaled units. If the constructor is called with a non-Decimal numeric amount, then the value is converted to a Decimal, e.g.:

```
Measurement(amount=0.006, unit=Weight())
```

is equivalent to:

```
from decimal import Decimal
Measurement(amount=Decimal(0.006), unit=Weight())
```

The measurement unit can be qualified by a second `per_unit` dimension, e.g. 2 mg/kg dosage per patient weight is expressed as:

```
Measurement(amount=0.002, unit=Weight(), per_unit=Weight(scale='k'))
```

Note the amount is a *Decimal* embedded object rather than the broken `MongoEngine DecimalField` (see the *Decimal* comment).

Initializes the Measurement document. The amount can be either a positional or a keyword argument. The amount is converted to a `Decimal`.

Parameters

- **args** – the amount as a positional argument
- **kwargs** – the following keyword arguments:
- **amount** – the amount as a keyword argument

`__init__` (*args, **kwargs)

Initializes the Measurement document. The amount can be either a positional or a keyword argument. The amount is converted to a `Decimal`.

Parameters

- **args** – the amount as a positional argument
- **kwargs** – the following keyword arguments:
- **amount** – the amount as a keyword argument

```
class qirest_client.model.uom.Radiation(*args, **kwargs)
```

Bases: `qirest_client.model.uom.Unit`

The radiation unit is always an unscaled Gray.

```
class qirest_client.model.uom.Unit(*args, **kwargs)
```

Bases: `mongoengine.document.EmbeddedDocument`

Unit is an abstract class for the supported measurement units. Each unit has a scaling factor with the default scaling factor defined in the concrete Unit subclass. Each Unit subclass has the following class variables:

- **BASE** - the standard unscaled metric unit abbreviation, e.g. `m` for the meter Extent unit.
- **SCALES** - the recommended scaling factors, e.g. `m` for milli and `c` for centi.

The scales are a list in preference order, e.g. the `Extent.SCALES` value `['c', 'm']` implies that the preferred extent unit display is `cm` (centimeter) and an edit form should show the scales `c` and `m`, in that order, defaulting to `c`. A scale of `None` signifies the scaling factor 1, e.g. the `Radiation.SCALES` value `[None, 'c']` implies that the preferred radiation unit display is `Gy` (Gray) and an edit form should show the scales blank and `c`, in that order, defaulting to blank (scaling factor 1).

These class variables are advisory. The client is responsible for displaying the base and scales and converting from a scaled value to an unscaled value before saving the measurement to the database.

facade

choices

choices

Choice utility functions.

`qirest_client.choices.max_length(choices)`

Returns the size of the longest choice.

Param the available choice strings or tuples

Returns the maximum length

`qirest_client.choices.roman_range_choices(start, stop)`

Returns the (arabic number, roman numeral) choice tuples for the given exclusive range bounds. This is useful, e.g., for displaying the tumor stage. (Yes, this is the 21st century).

Example:

```
>>> from qirest_client import choices
>>> choices.roman_range_choices(1, 5)
[('I', 1), ('II', 2), ('III', 3), ('IV', 4)]
```

Parameters

- **start** – the first value in the range
- **stop** – one greater than the last value in the range
- **roman** – flag indicating whether the display value is a roman numeral

Returns the [(value, label)] choices list

Raises **ValueError** – if the *roman* flag is set and start is less than one or stop is greater than five

Quantitative Imaging Profile (QiPr) REST Data Model

q

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