AutoCell

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Contents

Chapter 1

Main Page

To generate the Documentation, go in Documentation directory and run `make`.

It will generate html doc (in `output/html/index.html`) and latex doc (pdf output directely in Documentation directory (`docPdf.pdf`).

Chapter 2

Game of life

According to the requirements : a and b values are chosen by the user. No matter its current state, if the cell has between a and b neighbours living, it lives, else it dies/or stays dead. So the "current cell possible values" vector contains all the possible cell values (0 and 1) and the 2 pair contains (a, b) with an output state set at 1. 2 other rules, respectively with an interval of (0,a-1) and (b+1, 8) and an output state of 0 are created.

The game of life by John Horton Conway according to wikipedia:

"At each step, the cell evolution is determined by the state of its 8 neighbours as following: A dead cell which has exactly 3 living neighbours starts to live. An alive cell which has 2 or 3 living neighbours stays alive, else it dies."

1 : cell is alive 0 : cell is dead

```
// Rule 1: dead cell (state 0) starts living (state 1) if it has exactly 3 living neighbours (in state 1)

unsigned int rule1OutputState = 1; // output state is alive state

QVector<unsigned int> rule1CurrentCellValues;
rule1CurrentCellValues.insert(0); //current cell is dead

QPair<unsigned int, unsigned int> rule1intervalNbrNeighbours;
rule1IntervalNbrNeighbours.first = 3;
rule1IntervalNbrNeighbours.second = 3;

QSet<unsigned int> rule1NeighbourPossibleValues;
rule1NeighbourPossibleValues<<1; //living neighbours

NeighbourRule rule1 = NeighbourRule(rule1OutputState, rule1CurrentCellValues,
      rule1IntervalNbrNeighbours, rule1NeighbourPossibleValues);


// Rule 2: alive cell (state 1) dies (goes to state 0) if it has 0 to 1 living neighbours (in state 1)

unsigned int rule2OutputState = 0; // output state is dead state

QVector<unsigned int> rule2CurrentCellValues;
rule2CurrentCellValues.insert(1); //current cell is alive

QPair<unsigned int, unsigned int> rule2intervalNbrNeighbours;
rule2IntervalNbrNeighbours.first = 0;
rule2IntervalNbrNeighbours.second = 1;

QSet<unsigned int> rule2NeighbourPossibleValues;
rule2NeighbourPossibleValues<<1; //living neighbours

NeighbourRule rule2 = NeighbourRule(rule2OutputState, rule2CurrentCellValues,
      rule2IntervalNbrNeighbours, rule2NeighbourPossibleValues);


// Rule 3: alive cell (state 1) dies (goes to state 0) if it has 4 to 8 living neighbours (in state 1)

unsigned int rule3OutputState = 0; // output state is dead state
```

```
QVector<unsigned int> rule3CurrentCellValues;
rule2CurrentCellValues.insert(1); //current cell is alive

QPair<unsigned int, unsigned int> rule3intervalNbrNeighbours;
rule3IntervalNbrNeighbours.first = 4;
rule3IntervalNbrNeighbours.second = 8;

QSet<unsigned int> rule3NeighbourPossibleValues;
rule3NeighbourPossibleValues<<1; //living neighbours

NeighbourRule rule3 = NeighbourRule(rule3OutputState, rule3CurrentCellValues,
      rule3IntervalNbrNeighbours, rule3NeighbourPossibleValues);
```

Chapter 3

Presentation

What is AutoCell

The purpose of this project is to create a Cellular Automate Simulator.

Chapter 4

Hierarchical Index

4.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

Chapter 5

Class Index

5.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 6

File Index

6.1 File List

Here is a list of all files with brief descriptions:

Chapter 7

Class Documentation

7.1 Automate Class Reference

Manage the application of rules on the cells.

`#include <automate.h>`

Public Member Functions

- Automate (QString filename)

  Create an automate with only a cellHandler from file.
- Automate (const QVector< unsigned int > dimensions, CellHandler::generationTypes type=CellHandler::empty, unsigned int stateMax=1, unsigned int density=20)

  Create an automate with only a cellHandler with parameters.
- Automate (QString cellHandlerFilename, QString ruleFilename)

  Create an automate from files.
- virtual ~Automate ()

  Destructor : free the CellHandler and the rules !
- bool saveRules (QString filename) const

  Save automate's rules in the file.
- bool saveCells (QString filename) const

  Save cellHandler.
- bool saveAll (QString cellHandlerFilename, QString rulesFilename) const

  Save both rules and cellHandler in the differents files.
- void addRuleFile (QString filename)
- void addRule (const Rule *newRule)

  Add a new rule to the Automate. Careful, the rule will be destroyed with the Automate.
- void setRulePriority (const Rule *rule, unsigned int newPlace)

  Modify the place of the rule in the priority list.
- const QList< const Rule * > & getRules () const

  Return all the rules.
- bool run (unsigned int nbSteps=1)

  Apply the rule on the cells grid nbSteps times.
- const CellHandler & getCellHandler () const

  Accessor of m_cellHandler.

Private Member Functions

- bool loadRules (const QJsonArray &json)

  Load the rules of the json given.

Private Attributes

- CellHandler * m_cellHandler = nullptr

  CellHandler to go through.
- QList< const Rule * > m_rules

  Rules to use on the cells.

Friends

- class AutomateHandler

7.1.1 Detailed Description

Manage the application of rules on the cells.

Definition at line 15 of file automate.h.

7.1.2 Constructor & Destructor Documentation

7.1.2.1 Automate() [1/3]

```
Automate::Automate (
            QString cellHandlerFilename )
```

Create an automate with only a cellHandler from file.

Parameters

cellHandlerFilename	File to load

Definition at line 120 of file automate.cpp.

References m_cellHandler.

7.1.2.2 Automate() [2/3]

```
Automate::Automate (
            const QVector< unsigned int > dimensions,
```

```
            CellHandler::generationTypes type = CellHandler::empty,
            unsigned int stateMax = 1,
            unsigned int density = 20 )
```

Create an automate with only a cellHandler with parameters.

Parameters

dimensions	Dimensions of the CellHandler
type	Generation type, empty by default
stateMax	Generate states between 0 and stateMax
density	Average (%) of non-zeros

Definition at line 133 of file automate.cpp.

References m_cellHandler.

7.1.2.3 Automate() [3/3]

```
Automate::Automate (
            QString cellHandlerFilename,
            QString ruleFilename )
```

Create an automate from files.

Parameters

cellHandlerFilename	File of the cellHandler
ruleFilename	File of the rules

Definition at line 144 of file automate.cpp.

References loadRules(), and m_cellHandler.

7.1.2.4 ~Automate()

```
Automate::~Automate ( )  [virtual]
```

Destructor : free the CellHandler and the rules !

Definition at line 179 of file automate.cpp.

References m_cellHandler, and m_rules.

7.1.3 Member Function Documentation

7.1.3.1 addRule()

```
void Automate::addRule (
            const Rule * newRule )
```

Add a new rule to the Automate. Careful, the rule will be destroyed with the Automate.

Definition at line 230 of file automate.cpp.

References m_rules.

Referenced by MainWindow::addAutomatonRules().

7.1.3.2 addRuleFile()

```
void Automate::addRuleFile (
            QString filename )
```

Definition at line 287 of file automate.cpp.

References loadRules().

Referenced by MainWindow::addAutomatonRuleFile().

7.1.3.3 getCellHandler()

```
const CellHandler & Automate::getCellHandler ( ) const
```

Accessor of m_cellHandler.

Definition at line 282 of file automate.cpp.

References m_cellHandler.

Referenced by MainWindow::createTab(), and MainWindow::updateBoard().

7.1.3.4 getRules()

```
const QList< const Rule * > & Automate::getRules ( ) const
```

Return all the rules.

Definition at line 248 of file automate.cpp.

References m_rules.

7.1.3.5 loadRules()

```
bool Automate::loadRules (
            const QJsonArray & json )  [private]
```

Load the rules of the json given.

Returns

Return false if something went wrong

Parameters

json	JsonObject wich contains the rules

Definition at line 7 of file automate.cpp.

References MatrixRule::addNeighbourState(), CellHandler::getDimensions(), m_cellHandler, and m_rules.

Referenced by addRuleFile(), and Automate().

7.1.3.6 run()

```
bool Automate::run (
            unsigned int nbSteps = 1 )
```

Apply the rule on the cells grid nbSteps times.

Parameters

nbSteps	number of iterations of the automate on the cell grid

Definition at line 257 of file automate.cpp.

References CellHandler::begin(), CellHandler::end(), m_cellHandler, m_rules, and CellHandler::nextStates().

7.1.3.7 saveAll()

```
bool Automate::saveAll (
            QString cellHandlerFilename,
            QString rulesFilename ) const
```

Save both rules and cellHandler in the differents files.

Definition at line 223 of file automate.cpp.

References saveCells(), and saveRules().

Referenced by MainWindow::~MainWindow().

7.1.3.8 saveCells()

```
bool Automate::saveCells (
            QString filename ) const
```

Save cellHandler.

Definition at line 214 of file automate.cpp.

References m_cellHandler, and CellHandler::save().

Referenced by saveAll().

7.1.3.9 saveRules()

```
bool Automate::saveRules (
            QString filename ) const
```

Save automate's rules in the file.

Returns

False if something went wrong

Definition at line 192 of file automate.cpp.

References m_rules.

Referenced by saveAll().

7.1.3.10 setRulePriority()

```
void Automate::setRulePriority (
            const Rule * rule,
            unsigned int newPlace )
```

Modify the place of the rule in the priority list.

2 rules can't have the same priority rank

Parameters

rule	Rule to move
newPlace	New place of the rule

Definition at line 241 of file automate.cpp.

References m_rules.

7.1.4 Friends And Related Function Documentation

7.1.4.1 AutomateHandler

```
friend class AutomateHandler  [friend]
```

Definition at line 20 of file automate.h.

7.1.5 Member Data Documentation

7.1.5.1 m_cellHandler

```
CellHandler* Automate::m_cellHandler = nullptr  [private]
```

CellHandler to go through.

Definition at line 18 of file automate.h.

Referenced by Automate(), getCellHandler(), loadRules(), run(), saveCells(), and ~Automate().

7.1.5.2 m_rules

```
QList<const Rule*> Automate::m_rules  [private]
```

Rules to use on the cells.

Definition at line 19 of file automate.h.

Referenced by addRule(), getRules(), loadRules(), run(), saveRules(), setRulePriority(), and ~Automate().

The documentation for this class was generated from the following files:

- automate.h
- automate.cpp

7.2 AutomateHandler Class Reference

Implementation of singleton design pattern to manage the Automates.

```
#include <automatehandler.h>
```

Public Member Functions

- Automate * getAutomate (int indexAutomate)
  Get an automate from the list according to its index.
- unsigned int getNumberAutomates () const
  Get the number of automates contained in the automate list.
- void addAutomate (Automate *automate)
  Add an automate in the automate list.
- void deleteAutomate (Automate *automate)
  Delete an automate from the automate list.

Static Public Member Functions

- static AutomateHandler & getAutomateHandler ()

  Get the unique running automate handler instance or create one if there is no instance running.
- static void deleteAutomateHandler ()

  Delete the unique automate handler if it exists.

Private Member Functions

- AutomateHandler ()

  Construct an automate handler.
- AutomateHandler (const AutomateHandler &a)=delete
- AutomateHandler & operator= (const AutomateHandler &a)=delete
- ~AutomateHandler ()

  Delete all the automates contained in the automate handler.

Private Attributes

- QList< Automate * > m_ActiveAutomates

  list of existing automates

Static Private Attributes

- static AutomateHandler * m_activeAutomateHandler = nullptr

  active automate handler if existing, nullptr else

7.2.1 Detailed Description

Implementation of singleton design pattern to manage the Automates.

Definition at line 10 of file automatehandler.h.

7.2.2 Constructor & Destructor Documentation

7.2.2.1 AutomateHandler() [1/2]

```
AutomateHandler::AutomateHandler ( )  [private]
```

Construct an automate handler.

Definition at line 10 of file automatehandler.cpp.

Referenced by getAutomateHandler().

7.2.2.2 AutomateHandler() [2/2]

```
AutomateHandler::AutomateHandler (
            const AutomateHandler & a )  [private], [delete]
```

7.2.2.3 ~AutomateHandler()

```
AutomateHandler::~AutomateHandler ( )  [private]
```

Delete all the automates contained in the automate handler.

Definition at line 18 of file automatehandler.cpp.

References m_ActiveAutomates.

7.2.3 Member Function Documentation

7.2.3.1 addAutomate()

```
void AutomateHandler::addAutomate (
            Automate * automate )
```

Add an automate in the automate list.

Parameters

automate	to be added to the automate list

Definition at line 78 of file automatehandler.cpp.

References m_ActiveAutomates.

Referenced by MainWindow::MainWindow(), MainWindow::openFile(), and MainWindow::receiveCellHandler().

7.2.3.2 deleteAutomate()

```
void AutomateHandler::deleteAutomate (
            Automate * automate )
```

Delete an automate from the automate list.

Parameters

automate	automate to delete

Definition at line 89 of file automatehandler.cpp.

References m_ActiveAutomates.

Referenced by MainWindow::closeTab().

7.2.3.3 deleteAutomateHandler()

```
void AutomateHandler::deleteAutomateHandler ( )  [static]
```

Delete the unique automate handler if it exists.

Definition at line 39 of file automatehandler.cpp.

References m_activeAutomateHandler.

7.2.3.4 getAutomate()

```
Automate * AutomateHandler::getAutomate (
            int indexAutomate )
```

Get an automate from the list according to its index.

Parameters

indexAutomate	Index of a specific automate in the automate list

Returns

Pointer on the requested automated if the parameter index fits with the list size

Definition at line 55 of file automatehandler.cpp.

References m_ActiveAutomates.

Referenced by MainWindow::addAutomatonRuleFile(), MainWindow::addAutomatonRules(), MainWindow::backward(), MainWindow::cellPressed(), MainWindow::changeCellValue(), MainWindow::createTab(), MainWindow::nextState(), MainWindow::reset(), MainWindow::runAutomaton(), MainWindow::saveToFile(), MainWindow::updateBoard(), and MainWindow::~MainWindow().

7.2.3.5 getAutomateHandler()

```
AutomateHandler & AutomateHandler::getAutomateHandler ( )  [static]
```

Get the unique running automate handler instance or create one if there is no instance running.

Returns

the unique running automate handler instance

Definition at line 29 of file automatehandler.cpp.

References AutomateHandler(), and m_activeAutomateHandler.

Referenced by MainWindow::addAutomatonRuleFile(), MainWindow::addAutomatonRules(), MainWindow::backward(), MainWindow::cellPressed(), MainWindow::changeCellValue(), MainWindow::closeTab(), MainWindow::createTab(), MainWindow::handlePlayPause(), MainWindow::MainWindow(), MainWindow::nextState(), MainWindow::openFile(), MainWindow::receiveCellHandler(), MainWindow::reset(), MainWindow::runAutomaton(), MainWindow::saveToFile(), MainWindow::setSize(), MainWindow::updateBoard(), and MainWindow::~MainWindow().

7.2.3.6 getNumberAutomates()

```
unsigned int AutomateHandler::getNumberAutomates ( ) const
```

Get the number of automates contained in the automate list.

Returns

number of automates in the automate list

Definition at line 67 of file automatehandler.cpp.

References m_ActiveAutomates.

Referenced by MainWindow::~MainWindow().

7.2.3.7 operator=()

```
AutomateHandler& AutomateHandler::operator= (
            const AutomateHandler & a )  [private], [delete]
```

7.2.4 Member Data Documentation

7.2.4.1 m_activeAutomateHandler

```
AutomateHandler * AutomateHandler::m_activeAutomateHandler = nullptr  [static], [private]
```

active automate handler if existing, nullptr else

Initialization of the static value.

Definition at line 14 of file automatehandler.h.

Referenced by deleteAutomateHandler(), and getAutomateHandler().

7.2.4.2 m_ActiveAutomates

```
QList<Automate*> AutomateHandler::m_ActiveAutomates  [private]
```

list of existing automates

Definition at line 13 of file automatehandler.h.

Referenced by addAutomate(), deleteAutomate(), getAutomate(), getNumberAutomates(), and ~AutomateHandler().

The documentation for this class was generated from the following files:

- automatehandler.h
- automatehandler.cpp

7.3 Cell Class Reference

Contains the state, the next state and the neighbours.

`#include <cell.h>`

Public Member Functions

- Cell (unsigned int state=0)
  Constructs a cell with the state given. State 0 is dead state.
- void setState (unsigned int state)
  Set temporary state.
- void validState ()
  Validate temporary state.
- void forceState (unsigned int state)
  Force the state change.
- unsigned int getState () const
  Access current cell state.
- bool back ()
  Set the previous state.
- void reset ()
  Reset the cell to the 1st state.
- bool addNeighbour (const Cell *neighbour, const QVector< short > relativePosition)
  Add a new neighbour to the Cell.
- QMap< QVector< short >, const Cell * > getNeighbours () const
  Access neighbours list.
- const Cell * getNeighbour (QVector< short > relativePosition) const
  Get the neighbour asked. If not existent, return nullptr.
- unsigned int countNeighbours (unsigned int filterState) const
  Return the number of neighbour which have the given state.
- unsigned int countNeighbours () const
  Return the number of neighbour which are not dead (=0)

Static Public Member Functions

- static QVector< short > getRelativePosition (const QVector< unsigned int > cellPosition, const QVector< unsigned int > neighbourPosition)

  Get the relative position, as neighbourPosition minus cellPosition.

Private Attributes

- QStack< unsigned int > m_states

  Current state.
- unsigned int m_nextState

  Temporary state, before validation.
- QMap< QVector< short >, const Cell * > m_neighbours

  Cell's neighbours. Key is the relative position of the neighbour.

7.3.1 Detailed Description

Contains the state, the next state and the neighbours.

Definition at line 11 of file cell.h.

7.3.2 Constructor & Destructor Documentation

7.3.2.1 Cell()

```
Cell::Cell (
            unsigned int state = 0 )
```

Constructs a cell with the state given. State 0 is dead state.

Parameters

state	Cell state, dead state by default

Definition at line 7 of file cell.cpp.

References m_states.

7.3.3 Member Function Documentation

7.3.3.1 addNeighbour()

```
bool Cell::addNeighbour (
            const Cell * neighbour,
            const QVector< short > relativePosition )
```

Add a new neighbour to the Cell.

Parameters

relativePosition	Relative position of the new neighbour
neighbour	New neighbour

Returns

False if the neighbour already exists

Definition at line 84 of file cell.cpp.

References m_neighbours.

7.3.3.2 back()

```
bool Cell::back ( )
```

Set the previous state.

Returns

Return false if we are already at the first state

Definition at line 59 of file cell.cpp.

References m_nextState, and m_states.

7.3.3.3 countNeighbours() [1/2]

```
unsigned int Cell::countNeighbours (
            unsigned int filterState ) const
```

Return the number of neighbour which have the given state.

Definition at line 111 of file cell.cpp.

References m_neighbours.

Referenced by NeighbourRule::matchCell().

7.3.3.4 countNeighbours() [2/2]

```
unsigned int Cell::countNeighbours ( ) const
```

Return the number of neighbour which are not dead (=0)

Definition at line 124 of file cell.cpp.

References m_neighbours.

7.3.3.5 forceState()

```
void Cell::forceState (
            unsigned int state )
```

Force the state change.

Is equivalent to setState followed by validState

Parameters

state	New state

Definition at line 41 of file cell.cpp.

References m_nextState, and m_states.

Referenced by MainWindow::changeCellValue().

7.3.3.6 getNeighbour()

```
const Cell * Cell::getNeighbour (
            QVector< short > relativePosition ) const
```

Get the neighbour asked. If not existent, return nullptr.

Definition at line 104 of file cell.cpp.

References m_neighbours.

Referenced by MatrixRule::matchCell().

7.3.3.7 getNeighbours()

```
QMap< QVector< short >, const Cell * > Cell::getNeighbours ( ) const
```

Access neighbours list.

The map key is the relative position of the neighbour (like -1,0 for the cell just above)

Definition at line 97 of file cell.cpp.

References m_neighbours.

7.3.3.8 getRelativePosition()

```
QVector< short > Cell::getRelativePosition (
            const QVector< unsigned int > cellPosition,
            const QVector< unsigned int > neighbourPosition )  [static]
```

Get the relative position, as neighbourPosition minus cellPosition.

Exceptions

QString	Different size of position vectors

Parameters

cellPosition	Cell Position
neighbourPosition	Neighbour absolute position

Definition at line 141 of file cell.cpp.

Referenced by CellHandler::foundNeighbours().

7.3.3.9 getState()

```
unsigned int Cell::getState ( ) const
```

Access current cell state.

Definition at line 50 of file cell.cpp.

References m_states.

Referenced by MainWindow::cellPressed(), MatrixRule::matchCell(), and NeighbourRule::matchCell().

7.3.3.10 reset()

```
void Cell::reset ( )
```

Reset the cell to the 1st state.

Definition at line 70 of file cell.cpp.

References m_nextState, and m_states.

7.3.3.11 setState()

```
void Cell::setState (
            unsigned int state )
```

Set temporary state.

To change current cell state, use setState(unsigned int state) then validState(). (

Parameters

state	New state

Definition at line 20 of file cell.cpp.

References m_nextState.

7.3.3.12 validState()

```
void Cell::validState ( )
```

Validate temporary state.

To change current cell state, use setState(unsigned int state) then validState().

Definition at line 30 of file cell.cpp.

References m_nextState, and m_states.

7.3.4 Member Data Documentation

7.3.4.1 m_neighbours

```
QMap<QVector<short>, const Cell*> Cell::m_neighbours  [private]
```

Cell's neighbours. Key is the relative position of the neighbour.

Definition at line 37 of file cell.h.

Referenced by addNeighbour(), countNeighbours(), getNeighbour(), and getNeighbours().

7.3.4.2 m_nextState

```
unsigned int Cell::m_nextState  [private]
```

Temporary state, before validation.

Definition at line 35 of file cell.h.

Referenced by back(), forceState(), reset(), setState(), and validState().

7.3.4.3 m_states

```
QStack<unsigned int> Cell::m_states  [private]
```

Current state.

Definition at line 34 of file cell.h.

Referenced by back(), Cell(), forceState(), getState(), reset(), and validState().

The documentation for this class was generated from the following files:

- cell.h
- cell.cpp

7.4 CellHandler Class Reference

Cell container and cell generator.

```
#include <cellhandler.h>
```

Classes

- class iteratorT

  Implementation of iterator design pattern with a template to generate iterator and const_iterator at the same time.

Public Types

- enum generationTypes { empty, random, symetric }

  Type of random generation.
- typedef iteratorT< const CellHandler, const Cell > const_iterator
- typedef iteratorT< CellHandler, Cell > iterator

Public Member Functions

- CellHandler (const QString filename)

  Construct all the cells from the json file given.
- CellHandler (const QJsonObject &json)

  Construct all the cells from the json object given.
- CellHandler (const QVector< unsigned int > dimensions, generationTypes type=empty, unsigned int stateMax=1, unsigned int density=20)

  Construct a CellHandler of the given dimension.
- virtual ~CellHandler ()

  Destroys all cells in the CellHandler.
- Cell * getCell (const QVector< unsigned int > position) const

  Access the cell to the given position.
- QVector< unsigned int > getDimensions () const

  Accessor of m_dimensions.
- void nextStates () const

  Valid the state of all cells.
- bool previousStates () const

  Get all the cells to their previous states.
- void reset () const

  Reset all the cells to the 1st state.
- bool save (QString filename) const

  Save the CellHandler current configuration in the file given.
- void generate (generationTypes type, unsigned int stateMax=1, unsigned short density=50)

  Replace Cell values by random values (symetric or not)
- void print (std::ostream &stream) const

  Print in the given stream the CellHandler.
- const_iterator begin () const

  Give the iterator which corresponds to the current CellHandler.
- iterator begin ()

  Give the iterator which corresponds to the current CellHandler.
- bool end () const

  End condition of the iterator.

Static Public Member Functions

- static unsigned int getMaxState ()

  Return the max state of the CellHandler.

Private Member Functions

- bool load (const QJsonObject &json)

  Load the config file in the CellHandler.
- void foundNeighbours ()

  Set the neighbours of each cells.
- void positionIncrement (QVector< unsigned int > &pos, unsigned int value=1) const

  Increment the QVector given by the value choosen.
- QVector< QVector< unsigned int > > * getListNeighboursPositionsRecursive (const QVector< unsigned int > position, unsigned int dimension, QVector< unsigned int > lastAdd) const

  Recursive function which browse the position possibilities tree.
- QVector< QVector< unsigned int > > & getListNeighboursPositions (const QVector< unsigned int > position) const

  Prepare the call of the recursive version of itself.

Private Attributes

- QVector< unsigned int > m_dimensions

  Vector of x dimensions.
- QMap< QVector< unsigned int >, Cell *> m_cells

  Map of cells, with a x dimensions vector as key.

7.4.1 Detailed Description

Cell container and cell generator.

Generate cells from a json file.

Definition at line 20 of file cellhandler.h.

7.4.2 Member Typedef Documentation

7.4.2.1 const_iterator

```
typedef iteratorT<const CellHandler, const Cell> CellHandler::const_iterator
```

Definition at line 94 of file cellhandler.h.

7.4.2.2 iterator

```
typedef iteratorT<CellHandler, Cell> CellHandler::iterator
```

Definition at line 95 of file cellhandler.h.

7.4.3 Member Enumeration Documentation

7.4.3.1 generationTypes

```
enum CellHandler::generationTypes
```

Type of random generation.

Enumerator

empty	Only empty cells.
random	Random cells.
symetric	Random cells but with vertical symetry (on the 1st dimension component)

Definition at line 99 of file cellhandler.h.

7.4.4 Constructor & Destructor Documentation

7.4.4.1 CellHandler() [1/3]

```
CellHandler::CellHandler (
            const QString filename )
```

Construct all the cells from the json file given.

The size of "cells" array must be the product of all dimensions (60 in the following example). Typical Json file:

```
{
"dimensions":"3x4x5",
"cells":[0,1,4,4,2,5,3,4,2,4,
         4,2,5,0,0,0,0,0,0,0,
         2,4,1,1,1,1,1,2,1,1,
         0,0,0,0,0,0,2,2,2,2,
         3,4,5,1,2,0,9,0,0,0,
         1,2,0,0,0,0,1,2,3,2]
}
```

Parameters

filename	Json file which contains the description of all the cells

Exceptions

QString	Unreadable file
QString	Empty file
QString	Not valid file

Definition at line 25 of file cellhandler.cpp.

References foundNeighbours(), and load().

7.4.4.2 CellHandler() [2/3]

```
CellHandler::CellHandler (
            const QJsonObject & json )
```

Construct all the cells from the json object given.

The size of "cells" array must be the product of all dimensions (60 in the following example). Typical Json object:

```
{
"dimensions":"3x4x5",
"cells":[0,1,4,4,2,5,3,4,2,4,
         4,2,5,0,0,0,0,0,0,0,
         2,4,1,1,1,1,1,2,1,1,
         0,0,0,0,0,0,2,2,2,2,
         3,4,5,1,2,0,9,0,0,0,
         1,2,0,0,0,0,1,2,3,2]
}
```

Parameters

json	Json object which contains the description of all the cells

Exceptions

QString	Not valid file

Definition at line 76 of file cellhandler.cpp.

References foundNeighbours(), and load().

7.4.4.3 CellHandler() [3/3]

```
CellHandler::CellHandler (
            const QVector< unsigned int > dimensions,
            generationTypes type = empty,
            unsigned int stateMax = 1,
            unsigned int density = 20 )
```

Construct a CellHandler of the given dimension.

If generationTypes is given, the CellHandler won't be empty.

Parameters

dimensions	Dimensions of the CellHandler
type	Generation type, empty by default
stateMax	Generate states between 0 and stateMax
density	Average (%) of non-zeros

Definition at line 98 of file cellhandler.cpp.

References empty, foundNeighbours(), generate(), m_cells, m_dimensions, and positionIncrement().

7.4.4.4 ~CellHandler()

```
CellHandler::~CellHandler ( )  [virtual]
```

Destroys all cells in the CellHandler.

Definition at line 130 of file cellhandler.cpp.

References m_cells.

7.4.5 Member Function Documentation

7.4.5.1 begin() [1/2]

```
CellHandler::const_iterator CellHandler::begin ( ) const
```

Give the iterator which corresponds to the current CellHandler.

Definition at line 326 of file cellhandler.cpp.

Referenced by MainWindow::changeCellValue(), print(), Automate::run(), save(), and MainWindow::updateBoard().

7.4.5.2 begin() [2/2]

```
CellHandler::iterator CellHandler::begin ( )
```

Give the iterator which corresponds to the current CellHandler.

Definition at line 319 of file cellhandler.cpp.

7.4.5.3 end()

```
bool CellHandler::end ( ) const
```

End condition of the iterator.

See iterator::operator!=(bool finished) for further information.

Definition at line 335 of file cellhandler.cpp.

Referenced by MainWindow::changeCellValue(), print(), Automate::run(), save(), and MainWindow::updateBoard().

7.4.5.4 foundNeighbours()

```
void CellHandler::foundNeighbours ( )  [private]
```

Set the neighbours of each cells.

Careful, this is in O(n*3^d), with n the number of cells and d the number of dimensions

Definition at line 433 of file cellhandler.cpp.

References getListNeighboursPositions(), Cell::getRelativePosition(), m_cells, m_dimensions, and positionIncrement().

Referenced by CellHandler().

7.4.5.5 generate()

```
void CellHandler::generate (
            CellHandler::generationTypes type,
            unsigned int stateMax = 1,
            unsigned short density = 50 )
```

Replace Cell values by random values (symetric or not)

Parameters

type	Type of random generation
stateMax	Generate states between 0 and stateMax
density	Average (%) of non-zeros

Definition at line 240 of file cellhandler.cpp.

References m_cells, m_dimensions, positionIncrement(), random, and symetric.

Referenced by CellHandler().

7.4.5.6 getCell()

```
Cell * CellHandler::getCell (
            const QVector< unsigned int > position ) const
```

Access the cell to the given position.

Definition at line 140 of file cellhandler.cpp.

References m_cells.

Referenced by MainWindow::cellPressed(), and MainWindow::changeCellValue().

7.4.5.7 getDimensions()

```
QVector< unsigned int > CellHandler::getDimensions ( ) const
```

Accessor of m_dimensions.

Definition at line 154 of file cellhandler.cpp.

References m_dimensions.

Referenced by MainWindow::cellPressed(), MainWindow::changeCellValue(), MainWindow::createTab(), Automate::loadRules(), and MainWindow::updateBoard().

7.4.5.8 getListNeighboursPositions()

```
QVector< QVector< unsigned int > > & CellHandler::getListNeighboursPositions (
            const QVector< unsigned int > position ) const  [private]
```

Prepare the call of the recursive version of itself.

Parameters

position	Position of the central cell (x1,x2,x3,..,xn)

Returns

List of positions

Definition at line 492 of file cellhandler.cpp.

References getListNeighboursPositionsRecursive().

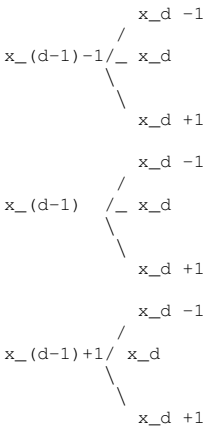
Referenced by foundNeighbours().

7.4.5.9 getListNeighboursPositionsRecursive()

```
QVector< QVector< unsigned int > > * CellHandler::getListNeighboursPositionsRecursive (
            const QVector< unsigned int > position,
            unsigned int dimension,
            QVector< unsigned int > lastAdd ) const  [private]
```

Recursive function which browse the position possibilities tree.

Careful, the complexity is in O(3^dimension)
Piece of the tree:



The path in the tree to reach the leaf give the position

Parameters

position	Position of the cell
dimension	Current working dimension (number of the digit). Dimension = 2 <=> working on x2 coordinates on (x1, x2, x3, ..., xn) vector
lastAdd	Last position added. Like the father node of the new tree

Returns

List of position

Definition at line 533 of file cellhandler.cpp.

References m_dimensions.

Referenced by getListNeighboursPositions().

7.4.5.10 getMaxState()

```
unsigned int CellHandler::getMaxState ( )  [static]
```

Return the max state of the CellHandler.

Definition at line 147 of file cellhandler.cpp.

Referenced by MainWindow::handleTabChanged().

7.4.5.11 load()

```
bool CellHandler::load (
            const QJsonObject & json )  [private]
```

Load the config file in the CellHandler.

Exemple of a way to print cell states :

```
QVector<unsigned int> position;
for (unsigned short i = 0; i < m_dimensions.size(); i++)
{
     position.push_back(0);
}
for (unsigned int j = 0; j < m_cells.size(); j++)
{
     std::cout << m_cells.value(position)->getState() << " ";
     position.replace(0, position.at(0)+1);
     for (unsigned short i = 0; i < m_dimensions.size(); i++)
     {
         if (position.at(i) >= m_dimensions.at(i))
         {
             position.replace(i, 0);
             std::cout << std::endl;
             if (i + 1 != m_dimensions.size())
                 position.replace(i+1, position.at(i+1)+1);
         }

     }
}
```

Parameters

json	Json Object which contains the grid configuration

Returns

False if the Json Object is not correct

Definition at line 370 of file cellhandler.cpp.

References m_cells, m_dimensions, and positionIncrement().

Referenced by CellHandler().

7.4.5.12 nextStates()

```
void CellHandler::nextStates ( ) const
```

Valid the state of all cells.

Definition at line 161 of file cellhandler.cpp.

References m_cells.

Referenced by Automate::run().

7.4.5.13 positionIncrement()

```
void CellHandler::positionIncrement (
            QVector< unsigned int > & pos,
            unsigned int value = 1 ) const  [private]
```

Increment the QVector given by the value choosen.

Careful, when the position reach the maximum, it goes to zero without leaving the function

Parameters

pos	Position to increment
value	Value to add, 1 by default

Definition at line 463 of file cellhandler.cpp.

References m_dimensions.

Referenced by CellHandler(), foundNeighbours(), generate(), and load().

7.4.5.14 previousStates()

```
bool CellHandler::previousStates ( ) const
```

Get all the cells to their previous states.

Definition at line 171 of file cellhandler.cpp.

References m_cells.

7.4.5.15 print()

```
void CellHandler::print (
            std::ostream & stream ) const
```

Print in the given stream the CellHandler.

Parameters

stream	Stream to print into

Definition at line 305 of file cellhandler.cpp.

References begin(), and end().

7.4.5.16 reset()

```
void CellHandler::reset ( ) const
```

Reset all the cells to the 1st state.

Definition at line 183 of file cellhandler.cpp.

References m_cells.

7.4.5.17 save()

```
bool CellHandler::save (
            QString filename ) const
```

Save the CellHandler current configuration in the file given.

Parameters

filename	Path to the file

Returns

False if there was a problem

Exceptions

QString	Impossible to open the file

Definition at line 198 of file cellhandler.cpp.

References begin(), end(), and m_dimensions.

Referenced by Automate::saveCells().

7.4.6 Member Data Documentation

7.4.6.1 m_cells

```
QMap<QVector<unsigned int>, Cell* > CellHandler::m_cells  [private]
```

Map of cells, with a x dimensions vector as key.

Definition at line 135 of file cellhandler.h.

Referenced by CellHandler(), foundNeighbours(), generate(), getCell(), load(), nextStates(), previousStates(), reset(), and ~CellHandler().

7.4.6.2 m_dimensions

```
QVector<unsigned int> CellHandler::m_dimensions  [private]
```

Vector of x dimensions.

Definition at line 134 of file cellhandler.h.

Referenced by CellHandler(), foundNeighbours(), generate(), getDimensions(), getListNeighboursPositionsRecursive(), load(), positionIncrement(), and save().

The documentation for this class was generated from the following files:

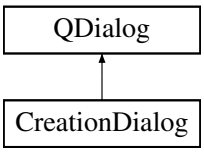
- cellhandler.h
- cellhandler.cpp

7.5 CreationDialog Class Reference

Automaton creation dialog box.

```
#include <creationdialog.h>
```

Inheritance diagram for CreationDialog:



Public Slots

- void processSettings ()

Signals

- void settingsFilled (const QVector< unsigned int > dimensions, CellHandler::generationTypes type=Cell↩ Handler::generationTypes::empty, unsigned int stateMax=1, unsigned int density=20)

Public Member Functions

- CreationDialog (QWidget *parent=0)

  Constructor of the cellHandler creation dialog.

Private Member Functions

- QGroupBox * createGenButtons ()

  Creates radio buttons to select cell generation type.

Private Attributes

- QLineEdit * m_dimensionsEdit
- QSpinBox * m_densityBox
- QSpinBox * m_stateMaxBox
- QPushButton * m_doneBt
- QGroupBox * m_groupBox
- QRadioButton * m_empGen
- QRadioButton * m_randGen
- QRadioButton * m_symGen

7.5.1 Detailed Description

Automaton creation dialog box.

Allow the user to input settings to create an automaton

Definition at line 13 of file creationdialog.h.

7.5.2 Constructor & Destructor Documentation

7.5.2.1 CreationDialog()

```
CreationDialog::CreationDialog (
            QWidget * parent = 0 )
```

Constructor of the cellHandler creation dialog.

Definition at line 6 of file creationdialog.cpp.

References createGenButtons(), m_densityBox, m_dimensionsEdit, m_doneBt, m_stateMaxBox, and processSettings().

7.5.3 Member Function Documentation

7.5.3.1 createGenButtons()

```
CreationDialog::createGenButtons ( )  [private]
```

Creates radio buttons to select cell generation type.

Validates user settings and sends them to MainWindow.

Definition at line 52 of file creationdialog.cpp.

References m_empGen, m_groupBox, m_randGen, and m_symGen.

Referenced by CreationDialog().

7.5.3.2 processSettings

```
void CreationDialog::processSettings ( )  [slot]
```

Definition at line 73 of file creationdialog.cpp.

References m_densityBox, m_dimensionsEdit, m_randGen, m_stateMaxBox, m_symGen, and settingsFilled().

Referenced by CreationDialog().

7.5.3.3 settingsFilled

```
void CreationDialog::settingsFilled (
            const QVector< unsigned int > dimensions,
            CellHandler::generationTypes type = CellHandler::generationTypes::empty,
            unsigned int stateMax = 1,
            unsigned int density = 20 )  [signal]
```

Referenced by processSettings().

7.5.4 Member Data Documentation

7.5.4.1 m_densityBox

```
QSpinBox* CreationDialog::m_densityBox  [private]
```

Definition at line 30 of file creationdialog.h.

Referenced by CreationDialog(), and processSettings().

7.5.4.2 m_dimensionsEdit

```
QLineEdit* CreationDialog::m_dimensionsEdit  [private]
```

Definition at line 29 of file creationdialog.h.

Referenced by CreationDialog(), and processSettings().

7.5.4.3 m_doneBt

```
QPushButton* CreationDialog::m_doneBt  [private]
```

Definition at line 32 of file creationdialog.h.

Referenced by CreationDialog().

7.5.4.4 m_empGen

```
QRadioButton* CreationDialog::m_empGen  [private]
```

Definition at line 35 of file creationdialog.h.

Referenced by createGenButtons().

7.5.4.5 m_groupBox

```
QGroupBox* CreationDialog::m_groupBox  [private]
```

Definition at line 34 of file creationdialog.h.

Referenced by createGenButtons().

7.5.4.6 m_randGen

```
QRadioButton* CreationDialog::m_randGen  [private]
```

Definition at line 36 of file creationdialog.h.

Referenced by createGenButtons(), and processSettings().

7.5.4.7 m_stateMaxBox

```
QSpinBox* CreationDialog::m_stateMaxBox  [private]
```

Definition at line 31 of file creationdialog.h.

Referenced by CreationDialog(), and processSettings().

7.5.4.8 m_symGen

```
QRadioButton* CreationDialog::m_symGen  [private]
```

Definition at line 37 of file creationdialog.h.

Referenced by createGenButtons(), and processSettings().

The documentation for this class was generated from the following files:

- creationdialog.h
- creationdialog.cpp

7.6 CellHandler::iteratorT< CellHandler_T, Cell_T > Class Template Reference

Implementation of iterator design pattern with a template to generate iterator and const_iterator at the same time.

Public Member Functions

- iteratorT (CellHandler_T *handler)

  Construct an initial iterator to browse the CellHandler.
- iteratorT & operator++ ()

  Increment the current position and handle dimension changes.
- Cell_T * operator-> () const

  Get the current cell.
- Cell_T * operator* () const

  Get the current cell.
- bool operator!= (bool finished) const
- unsigned int changedDimension () const

Private Attributes

- CellHandler_T * m_handler

  CellHandler to go through.
- QVector< unsigned int > m_position

  Current position of the iterator.
- bool m_finished = false

  If we reach the last position.
- QVector< unsigned int > m_zero

  Nul vector of the good dimension (depend of m_handler)
- unsigned int m_changedDimension

  Save the number of dimension change.

Friends

- class CellHandler

7.6.1 Detailed Description

template<typename CellHandler_T, typename Cell_T>
class CellHandler::iteratorT< CellHandler_T, Cell_T >

Implementation of iterator design pattern with a template to generate iterator and const_iterator at the same time.

Example of use:

```
CellHandler handler("file.atc");
for (CellHandler::const_iterator it = handler.begin(); it != handler.end(); ++it
      )
{
     for (unsigned int i = 0; i < it.changedDimension(); i++)
         std::cout << std::endl;
     std::cout << it->getState() << " ";
}
```

This code will print each cell states and go to a new line when there is a change of dimension. So if there are 3 dimensions, there will be a empty line between 2D groups.

Definition at line 41 of file cellhandler.h.

7.6.2 Constructor & Destructor Documentation

7.6.2.1 iteratorT()

```
template<typename CellHandler_T , typename Cell_T >
CellHandler::iteratorT< CellHandler_T, Cell_T >::iteratorT (
             CellHandler_T * handler )
```

Construct an initial iterator to browse the CellHandler.

Parameters

handler	CellHandler to browse

Definition at line 573 of file cellhandler.cpp.

References CellHandler::iteratorT< CellHandler_T, Cell_T >::m_position, and CellHandler::iteratorT< CellHandler_T, Cell_T >::m_z

7.6.3 Member Function Documentation

7.6.3.1 changedDimension()

```
template<typename CellHandler_T , typename Cell_T >
unsigned int CellHandler::iteratorT< CellHandler_T, Cell_T >::changedDimension ( ) const
[inline]
```

Definition at line 80 of file cellhandler.h.

References CellHandler::iteratorT< CellHandler_T, Cell_T >::m_changedDimension.

7.6.3.2 operator"!=()

```
template<typename CellHandler_T , typename Cell_T >
bool CellHandler::iteratorT< CellHandler_T, Cell_T >::operator!= (
            bool finished ) const  [inline]
```

Definition at line 79 of file cellhandler.h.

References CellHandler::iteratorT< CellHandler_T, Cell_T >::m_finished.

7.6.3.3 operator*()

```
template<typename CellHandler_T , typename Cell_T >
Cell_T* CellHandler::iteratorT< CellHandler_T, Cell_T >::operator* ( ) const  [inline]
```

Get the current cell.

Definition at line 75 of file cellhandler.h.

References CellHandler::iteratorT< CellHandler_T, Cell_T >::m_handler, and CellHandler::iteratorT< CellHandler_T, Cell_T >::m_p

7.6.3.4 operator++()

```
template<typename CellHandler_T , typename Cell_T >
iteratorT& CellHandler::iteratorT< CellHandler_T, Cell_T >::operator++ ( )  [inline]
```

Increment the current position and handle dimension changes.

Definition at line 47 of file cellhandler.h.

References CellHandler::iteratorT< CellHandler_T, Cell_T >::m_changedDimension, CellHandler::iteratorT< CellHandler_T, Cell_T
CellHandler::iteratorT< CellHandler_T, Cell_T >::m_handler, CellHandler::iteratorT< CellHandler_T, Cell_T >::m_position,
and CellHandler::iteratorT< CellHandler_T, Cell_T >::m_zero.

7.6.3.5 operator->()

```
template<typename CellHandler_T , typename Cell_T >
Cell_T* CellHandler::iteratorT< CellHandler_T, Cell_T >::operator-> ( ) const  [inline]
```

Get the current cell.

Definition at line 71 of file cellhandler.h.

References CellHandler::iteratorT< CellHandler_T, Cell_T >::m_handler, and CellHandler::iteratorT< CellHandler_T, Cell_T >::m_p

7.6.4 Friends And Related Function Documentation

7.6.4.1 CellHandler

```
template<typename CellHandler_T , typename Cell_T >
friend class CellHandler  [friend]
```

Definition at line 43 of file cellhandler.h.

7.6.5 Member Data Documentation

7.6.5.1 m_changedDimension

```
template<typename CellHandler_T , typename Cell_T >
unsigned int CellHandler::iteratorT< CellHandler_T, Cell_T >::m_changedDimension  [private]
```

Save the number of dimension change.

Definition at line 91 of file cellhandler.h.

Referenced by CellHandler::iteratorT< CellHandler_T, Cell_T >::changedDimension(), and CellHandler::iteratorT< CellHandler_T, C

7.6.5.2 m_finished

```
template<typename CellHandler_T , typename Cell_T >
bool CellHandler::iteratorT< CellHandler_T, Cell_T >::m_finished = false  [private]
```

If we reach the last position.

Definition at line 89 of file cellhandler.h.

Referenced by CellHandler::iteratorT< CellHandler_T, Cell_T >::operator!=(), and CellHandler::iteratorT< CellHandler_T, Cell_T >::

7.6.5.3 m_handler

```
template<typename CellHandler_T , typename Cell_T >
CellHandler_T* CellHandler::iteratorT< CellHandler_T, Cell_T >::m_handler  [private]
```

CellHandler to go through.

Definition at line 87 of file cellhandler.h.

Referenced by CellHandler::iteratorT< CellHandler_T, Cell_T >::operator*(), CellHandler::iteratorT< CellHandler_T, Cell_T >::opera
and CellHandler::iteratorT< CellHandler_T, Cell_T >::operator->().

7.6.5.4 m_position

```
template<typename CellHandler_T , typename Cell_T >
QVector<unsigned int> CellHandler::iteratorT< CellHandler_T, Cell_T >::m_position  [private]
```

Current position of the iterator.

Definition at line 88 of file cellhandler.h.

Referenced by CellHandler::iteratorT< CellHandler_T, Cell_T >::iteratorT(), CellHandler::iteratorT< CellHandler_T, Cell_T >::operat
CellHandler::iteratorT< CellHandler_T, Cell_T >::operator++(), and CellHandler::iteratorT< CellHandler_T, Cell_T >::operator->().

7.6.5.5 m_zero

```
template<typename CellHandler_T , typename Cell_T >
QVector<unsigned int> CellHandler::iteratorT< CellHandler_T, Cell_T >::m_zero  [private]
```

Nul vector of the good dimension (depend of m_handler)

Definition at line 90 of file cellhandler.h.

Referenced by CellHandler::iteratorT< CellHandler_T, Cell_T >::iteratorT(), and CellHandler::iteratorT< CellHandler_T, Cell_T >::op

The documentation for this class was generated from the following files:

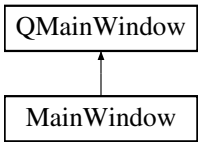
- cellhandler.h
- cellhandler.cpp

7.7 MainWindow Class Reference

Simulation window.

```
#include <mainwindow.h>
```

Inheritance diagram for MainWindow:



Public Slots

- void openFile ()

  Opens a file browser for the user to select automaton files and creates an automaton.
- void saveToFile ()

  Allows user to select a location and saves automaton's state and settings.
- void openCreationWindow ()

  Opens the automaton creation window.
- void receiveCellHandler (const QVector< unsigned int > dimensions, CellHandler::generationTypes type=CellHandler::generationTypes::empty, unsigned int stateMax=1, unsigned int density=20)

  Creates a new cellHandler with the provided arguments and updates the board with the created cellHandler.
- void addAutomatonRules (QList< const Rule *> rules)

  Adds a list of rules to the last Automaton.
- void addAutomatonRuleFile (QString path)

  Adds a list of rules to the last Automaton from a given file.
- void forward ()

  Show the Automaton's next state.
- void backward ()

  Show the Automaton's previous state.
- void closeTab (int n)

  Closes the tab at index n. Before closing, prompts the user to save the automaton.
- void runAutomaton ()

  Runs the automaton simulation. Displays a new state on the board at regular intervals, set by the user in the interface.
- void handlePlayPause ()

  Handles the press event of the play/pause button.
- void reset ()

  Resets the current Automaton, by setting its cells to their initial state.
- void cellPressed (int i, int j)

  Handles board cell press event.
- void changeCellValue ()

  Sets the selected cell's value to the one set by the user.
- void handleTabChanged ()

  Handles tab change.
- void setSize (int newCellSize)

  Change the size of the board.

Public Member Functions

- MainWindow (QWidget *parent=nullptr)

  Constructor of the main window.
- virtual ~MainWindow ()

  Destructor of the main window.

Private Member Functions

- void createButtons ()

  Creates and connects buttons for the MainWindow.
- void createToolBar ()

  Creates the toolBar for the MainWindow.
- void createBoard ()
- QWidget * createTab ()

  Creates a new Tab with an empty board.
- void createTabs ()

  Creates a QTabWidget for the main window and displays it.
- void addEmptyRow (unsigned int n)

  Add an empty row at the end of the board.
- void updateBoard (int index)

  Updates cells on the board on the tab at the given index with the cellHandler's cells states.
- void nextState (unsigned int n)

  Shows the nth next state of the automaton on the board.
- QTableWidget * getBoard (int n)

  Returns the board of the n-th tab.

Static Private Member Functions

- static QColor getColor (int cellState)

  Return the color wich correspond to the cellState.

Private Attributes

- QTabWidget * m_tabs

  Tabs for the main window.
- QIcon m_playIcon
- QIcon m_pauseIcon
- QToolButton * m_playPauseBt
- QToolButton * m_nextStateBt
- QToolButton * m_previousStateBt
- QToolButton * m_openAutomatonBt
- QToolButton * m_saveAutomatonBt
- QToolButton * m_newAutomatonBt
- QToolButton * m_resetBt
- QSpinBox * m_timeStep

  Simulation time step duration input.
- QSpinBox * m_cellSetter

  Cell state manual modification.
- QTimer * m_timer

  Timer running between simulation steps.
- QSlider * m_zoom

  Slider for the zoom.
- bool m_running

  If the automaton is running.
- QToolBar * m_toolBar

  Toolbar containing the buttons.
- int m_currentCellX
- int m_currentCellY
- unsigned int m_boardHSize = 25
- unsigned int m_boardVSize = 25
- unsigned int m_cellSize = 30

7.7.1 Detailed Description

Simulation window.

Displays the automaton's current state as a board and contains user interaction components.

Definition at line 18 of file mainwindow.h.

7.7.2 Constructor & Destructor Documentation

7.7.2.1 MainWindow()

```
MainWindow::MainWindow (
            QWidget * parent = nullptr )  [explicit]
```

Constructor of the main window.

Definition at line 7 of file mainwindow.cpp.

References AutomateHandler::addAutomate(), createButtons(), createTab(), createTabs(), createToolBar(), AutomateHandler::getAutomateHandler(), m_running, m_tabs, m_timeStep, m_zoom, and updateBoard().

7.7.2.2 ~MainWindow()

```
MainWindow::~MainWindow ( )  [virtual]
```

Destructor of the main window.

It is here that the settings are saved

Definition at line 51 of file mainwindow.cpp.

References AutomateHandler::getAutomate(), AutomateHandler::getAutomateHandler(), AutomateHandler::getNumberAutomates(), m_timeStep, m_zoom, and Automate::saveAll().

7.7.3 Member Function Documentation

7.7.3.1 addAutomatonRuleFile

```
void MainWindow::addAutomatonRuleFile (
            QString path )  [slot]
```

Adds a list of rules to the last Automaton from a given file.

Definition at line 529 of file mainwindow.cpp.

References Automate::addRuleFile(), AutomateHandler::getAutomate(), and AutomateHandler::getAutomateHandler().

Referenced by openFile(), and receiveCellHandler().

7.7.3.2 addAutomatonRules

```
void MainWindow::addAutomatonRules (
            QList< const Rule *> rules )  [slot]
```

Adds a list of rules to the last Automaton.

Definition at line 518 of file mainwindow.cpp.

References Automate::addRule(), AutomateHandler::getAutomate(), and AutomateHandler::getAutomateHandler().

Referenced by openFile(), and receiveCellHandler().

7.7.3.3 addEmptyRow()

```
void MainWindow::addEmptyRow (
            unsigned int n )  [private]
```

Add an empty row at the end of the board.

Used only in case of 1 dimension automaton

Parameters

n	Index of the board

Definition at line 489 of file mainwindow.cpp.

References getBoard(), and m_cellSize.

Referenced by updateBoard().

7.7.3.4 backward

```
void MainWindow::backward ( )  [slot]
```

Show the Automaton's previous state.

Definition at line 603 of file mainwindow.cpp.

References AutomateHandler::getAutomate(), AutomateHandler::getAutomateHandler(), m_tabs, and updateBoard().

Referenced by createButtons().

7.7.3.5 cellPressed

```
void MainWindow::cellPressed (
            int i,
            int j )  [slot]
```

Handles board cell press event.

Definition at line 612 of file mainwindow.cpp.

References AutomateHandler::getAutomate(), AutomateHandler::getAutomateHandler(), CellHandler::getCell(), CellHandler::getDimensions(), Cell::getState(), m_cellSetter, m_currentCellX, m_currentCellY, and m_tabs.

Referenced by createTab().

7.7.3.6 changeCellValue

```
void MainWindow::changeCellValue ( )  [slot]
```

Sets the selected cell's value to the one set by the user.

Definition at line 634 of file mainwindow.cpp.

References CellHandler::begin(), CellHandler::end(), Cell::forceState(), AutomateHandler::getAutomate(), AutomateHandler::getAutomateHandler(), getBoard(), CellHandler::getCell(), getColor(), CellHandler::getDimensions(), m_cellSetter, m_currentCellX, m_currentCellY, m_tabs, and updateBoard().

Referenced by createToolBar().

7.7.3.7 closeTab

```
void MainWindow::closeTab (
            int n )  [slot]
```

Closes the tab at index n. Before closing, prompts the user to save the automaton.

Definition at line 507 of file mainwindow.cpp.

References AutomateHandler::deleteAutomate(), AutomateHandler::getAutomateHandler(), m_tabs, and saveToFile().

Referenced by createTabs().

7.7.3.8 createBoard()

```
void MainWindow::createBoard ( )  [private]
```

7.7.3.9 createButtons()

```
void MainWindow::createButtons ( )  [private]
```

Creates and connects buttons for the MainWindow.

Definition at line 71 of file mainwindow.cpp.

References backward(), forward(), handlePlayPause(), m_cellSize, m_newAutomatonBt, m_nextStateBt, m_openAutomatonBt, m_pauseIcon, m_playIcon, m_playPauseBt, m_previousStateBt, m_resetBt, m_saveAutomatonBt, m_zoom, nextState(), openCreationWindow(), openFile(), reset(), saveToFile(), and setSize().

Referenced by MainWindow().

7.7.3.10 createTab()

```
QWidget * MainWindow::createTab ( )  [private]
```

Creates a new Tab with an empty board.

Definition at line 212 of file mainwindow.cpp.

References cellPressed(), AutomateHandler::getAutomate(), AutomateHandler::getAutomateHandler(), Automate::getCellHandler(), CellHandler::getDimensions(), and m_cellSize.

Referenced by MainWindow(), openFile(), and receiveCellHandler().

7.7.3.11 createTabs()

```
void MainWindow::createTabs ( )  [private]
```

Creates a QTabWidget for the main window and displays it.

Definition at line 474 of file mainwindow.cpp.

References closeTab(), handleTabChanged(), and m_tabs.

Referenced by MainWindow(), openFile(), and receiveCellHandler().

7.7.3.12 createToolBar()

```
void MainWindow::createToolBar ( )  [private]
```

Creates the toolBar for the MainWindow.

Definition at line 159 of file mainwindow.cpp.

References changeCellValue(), m_cellSetter, m_newAutomatonBt, m_nextStateBt, m_openAutomatonBt, m_playPauseBt, m_previousStateBt, m_resetBt, m_saveAutomatonBt, m_timeStep, m_toolBar, and m_zoom.

Referenced by MainWindow().

7.7.3.13 forward

```
void MainWindow::forward ( )  [slot]
```

Show the Automaton's next state.

Definition at line 400 of file mainwindow.cpp.

References nextState().

Referenced by createButtons().

7.7.3.14 getBoard()

```
QTableWidget * MainWindow::getBoard (
            int n )  [private]
```

Returns the board of the n-th tab.

Definition at line 407 of file mainwindow.cpp.

References m_tabs.

Referenced by addEmptyRow(), changeCellValue(), reset(), setSize(), and updateBoard().

7.7.3.15 getColor()

```
QColor MainWindow::getColor (
            int cellState )  [static], [private]
```

Return the color wich correspond to the cellState.

Definition at line 413 of file mainwindow.cpp.

Referenced by changeCellValue(), and updateBoard().

7.7.3.16 handlePlayPause

```
void MainWindow::handlePlayPause ( )  [slot]
```

Handles the press event of the play/pause button.

Definition at line 537 of file mainwindow.cpp.

References AutomateHandler::getAutomateHandler(), m_pauseIcon, m_playIcon, m_playPauseBt, m_running, m_timer, m_timeStep, and runAutomaton().

Referenced by createButtons().

7.7.3.17 handleTabChanged

```
void MainWindow::handleTabChanged ( )  [slot]
```

Handles tab change.

Definition at line 670 of file mainwindow.cpp.

References CellHandler::getMaxState(), m_cellSetter, m_currentCellX, m_currentCellY, m_playIcon, m_playPauseBt, m_running, m_tabs, and m_timer.

Referenced by createTabs().

7.7.3.18 nextState()

```
void MainWindow::nextState (
            unsigned int n )  [private]
```

Shows the nth next state of the automaton on the board.

Definition at line 333 of file mainwindow.cpp.

References AutomateHandler::getAutomate(), AutomateHandler::getAutomateHandler(), m_tabs, and updateBoard().

Referenced by createButtons(), and forward().

7.7.3.19 openCreationWindow

```
void MainWindow::openCreationWindow ( )  [slot]
```

Opens the automaton creation window.

Definition at line 298 of file mainwindow.cpp.

References receiveCellHandler().

Referenced by createButtons().

7.7.3.20 openFile

```
void MainWindow::openFile ( )  [slot]
```

Opens a file browser for the user to select automaton files and creates an automaton.

Definition at line 258 of file mainwindow.cpp.

References AutomateHandler::addAutomate(), addAutomatonRuleFile(), addAutomatonRules(), createTab(), createTabs(), AutomateHandler::getAutomateHandler(), m_tabs, and updateBoard().

Referenced by createButtons().

7.7.3.21 receiveCellHandler

```
void MainWindow::receiveCellHandler (
            const QVector< unsigned int > dimensions,
            CellHandler::generationTypes type = CellHandler::generationTypes::empty,
            unsigned int stateMax = 1,
            unsigned int density = 20 )  [slot]
```

Creates a new cellHandler with the provided arguments and updates the board with the created cellHandler.

Definition at line 311 of file mainwindow.cpp.

References AutomateHandler::addAutomate(), addAutomatonRuleFile(), addAutomatonRules(), createTab(), createTabs(), AutomateHandler::getAutomateHandler(), m_tabs, and updateBoard().

Referenced by openCreationWindow().

7.7.3.22 reset

```
void MainWindow::reset ( )  [slot]
```

Resets the current Automaton, by setting its cells to their initial state.

Definition at line 576 of file mainwindow.cpp.

References AutomateHandler::getAutomate(), AutomateHandler::getAutomateHandler(), getBoard(), m_tabs, and updateBoard().

Referenced by createButtons().

7.7.3.23 runAutomaton

```
void MainWindow::runAutomaton ( )  [slot]
```

Runs the automaton simulation. Displays a new state on the board at regular intervals, set by the user in the interface.

Definition at line 564 of file mainwindow.cpp.

References AutomateHandler::getAutomate(), AutomateHandler::getAutomateHandler(), m_running, m_tabs, and updateBoard().

Referenced by handlePlayPause().

7.7.3.24 saveToFile

```
void MainWindow::saveToFile ( )  [slot]
```

Allows user to select a location and saves automaton's state and settings.

Definition at line 278 of file mainwindow.cpp.

References AutomateHandler::getAutomate(), AutomateHandler::getAutomateHandler(), and m_tabs.

Referenced by closeTab(), and createButtons().

7.7.3.25 setSize

```
void MainWindow::setSize (
            int newCellSize )  [slot]
```

Change the size of the board.

Parameters

newCellSize	New Cell size

Definition at line 687 of file mainwindow.cpp.

References AutomateHandler::getAutomateHandler(), getBoard(), m_cellSize, and m_tabs.

Referenced by createButtons().

7.7.3.26 updateBoard()

```
void MainWindow::updateBoard (
            int index )  [private]
```

Updates cells on the board on the tab at the given index with the cellHandler's cells states.

Definition at line 350 of file mainwindow.cpp.

References addEmptyRow(), CellHandler::begin(), CellHandler::end(), AutomateHandler::getAutomate(), AutomateHandler::getAutomateHandler(), getBoard(), Automate::getCellHandler(), getColor(), CellHandler::getDimensions(), and m_tabs.

Referenced by backward(), changeCellValue(), MainWindow(), nextState(), openFile(), receiveCellHandler(), reset(), and runAutomaton().

7.7.4 Member Data Documentation

7.7.4.1 m_boardHSize

```
unsigned int MainWindow::m_boardHSize = 25  [private]
```

Definition at line 51 of file mainwindow.h.

7.7.4.2 m_boardVSize

```
unsigned int MainWindow::m_boardVSize = 25  [private]
```

Definition at line 52 of file mainwindow.h.

7.7.4.3 m_cellSetter

```
QSpinBox* MainWindow::m_cellSetter  [private]
```

Cell state manual modification.

Definition at line 39 of file mainwindow.h.

Referenced by cellPressed(), changeCellValue(), createToolBar(), and handleTabChanged().

7.7.4.4 m_cellSize

```
unsigned int MainWindow::m_cellSize = 30  [private]
```

Definition at line 53 of file mainwindow.h.

Referenced by addEmptyRow(), createButtons(), createTab(), and setSize().

7.7.4.5 m_currentCellX

```
int MainWindow::m_currentCellX  [private]
```

Definition at line 47 of file mainwindow.h.

Referenced by cellPressed(), changeCellValue(), and handleTabChanged().

7.7.4.6 m_currentCellY

```
int MainWindow::m_currentCellY  [private]
```

Definition at line 48 of file mainwindow.h.

Referenced by cellPressed(), changeCellValue(), and handleTabChanged().

7.7.4.7 m_newAutomatonBt

```
QToolButton* MainWindow::m_newAutomatonBt  [private]
```

Definition at line 34 of file mainwindow.h.

Referenced by createButtons(), and createToolBar().

7.7.4.8 m_nextStateBt

```
QToolButton* MainWindow::m_nextStateBt  [private]
```

Definition at line 30 of file mainwindow.h.

Referenced by createButtons(), and createToolBar().

7.7.4.9 m_openAutomatonBt

```
QToolButton* MainWindow::m_openAutomatonBt  [private]
```

Definition at line 32 of file mainwindow.h.

Referenced by createButtons(), and createToolBar().

7.7.4.10 m_pauseIcon

```
QIcon MainWindow::m_pauseIcon  [private]
```

Definition at line 26 of file mainwindow.h.

Referenced by createButtons(), and handlePlayPause().

7.7.4.11 m_playIcon

```
QIcon MainWindow::m_playIcon  [private]
```

Definition at line 25 of file mainwindow.h.

Referenced by createButtons(), handlePlayPause(), and handleTabChanged().

7.7.4.12 m_playPauseBt

```
QToolButton* MainWindow::m_playPauseBt  [private]
```

Definition at line 29 of file mainwindow.h.

Referenced by createButtons(), createToolBar(), handlePlayPause(), and handleTabChanged().

7.7.4.13 m_previousStateBt

```
QToolButton* MainWindow::m_previousStateBt  [private]
```

Definition at line 31 of file mainwindow.h.

Referenced by createButtons(), and createToolBar().

7.7.4.14 m_resetBt

```
QToolButton* MainWindow::m_resetBt  [private]
```

Definition at line 35 of file mainwindow.h.

Referenced by createButtons(), and createToolBar().

7.7.4.15 m_running

```
bool MainWindow::m_running  [private]
```

If the automaton is running.

Definition at line 44 of file mainwindow.h.

Referenced by handlePlayPause(), handleTabChanged(), MainWindow(), and runAutomaton().

7.7.4.16 m_saveAutomatonBt

```
QToolButton* MainWindow::m_saveAutomatonBt  [private]
```

Definition at line 33 of file mainwindow.h.

Referenced by createButtons(), and createToolBar().

7.7.4.17 m_tabs

```
QTabWidget* MainWindow::m_tabs  [private]
```

Tabs for the main window.

Definition at line 22 of file mainwindow.h.

Referenced by backward(), cellPressed(), changeCellValue(), closeTab(), createTabs(), getBoard(), handleTabChanged(), MainWindow(), nextState(), openFile(), receiveCellHandler(), reset(), runAutomaton(), saveToFile(), setSize(), and updateBoard().

7.7.4.18 m_timer

```
QTimer* MainWindow::m_timer  [private]
```

Timer running between simulation steps.

Definition at line 40 of file mainwindow.h.

Referenced by handlePlayPause(), and handleTabChanged().

7.7.4.19 m_timeStep

```
QSpinBox* MainWindow::m_timeStep  [private]
```

Simulation time step duration input.

Definition at line 38 of file mainwindow.h.

Referenced by createToolBar(), handlePlayPause(), MainWindow(), and ~MainWindow().

7.7.4.20 m_toolBar

```
QToolBar* MainWindow::m_toolBar  [private]
```

Toolbar containing the buttons.

Definition at line 45 of file mainwindow.h.

Referenced by createToolBar().

7.7.4.21 m_zoom

```
QSlider* MainWindow::m_zoom  [private]
```

Slider for the zoom.

Definition at line 42 of file mainwindow.h.

Referenced by createButtons(), createToolBar(), MainWindow(), and ~MainWindow().

The documentation for this class was generated from the following files:

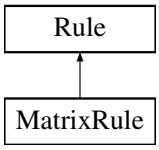
- mainwindow.h
- mainwindow.cpp

7.8 MatrixRule Class Reference

Manage specific rules, about specific values of specific neighbour.

`#include <matrixrule.h>`

Inheritance diagram for MatrixRule:



Public Member Functions

- MatrixRule (unsigned int finalState, QVector< unsigned int > currentStates=QVector< unsigned int >())
  Constructor.
- virtual bool matchCell (const Cell *cell) const
  Tells if the cell match the rule.
- virtual void addNeighbourState (QVector< short > relativePosition, unsigned int matchState)
  Add a possible state to a relative position.
- virtual void addNeighbourState (QVector< short > relativePosition, QVector< unsigned int > matchStates)
  Add multiples possible states to existents states.
- QJsonObject toJson () const
  Return a QJsonObject to save the rule.

Protected Attributes

- QMap< QVector< short >, QVector< unsigned int > > m_matrix
  Key correspond to relative position and the value to matchable states.

7.8.1 Detailed Description

Manage specific rules, about specific values of specific neighbour.

Definition at line 13 of file matrixrule.h.

7.8.2 Constructor & Destructor Documentation

7.8.2.1 MatrixRule()

```
MatrixRule::MatrixRule (
            unsigned int finalState,
            QVector< unsigned int > currentStates = QVector<unsigned int>() )
```

Constructor.

Parameters

finalState	Final state if the rule match the cell
currentStates	Possibles states of the cell. Nothing means all states

Definition at line 21 of file matrixrule.cpp.

7.8.3 Member Function Documentation

7.8.3.1 addNeighbourState() [1/2]

```
void MatrixRule::addNeighbourState (
            QVector< short > relativePosition,
            unsigned int matchState )  [virtual]
```

Add a possible state to a relative position.

Definition at line 67 of file matrixrule.cpp.

References m_matrix.

Referenced by getRuleFromNumber(), and Automate::loadRules().

7.8.3.2 addNeighbourState() [2/2]

```
void MatrixRule::addNeighbourState (
            QVector< short > relativePosition,
            QVector< unsigned int > matchStates )  [virtual]
```

Add multiples possible states to existents states.

Definition at line 74 of file matrixrule.cpp.

References m_matrix.

7.8.3.3 matchCell()

```
bool MatrixRule::matchCell (
            const Cell * cell ) const  [virtual]
```

Tells if the cell match the rule.

Parameters

cell	Cell to test

Returns

True if the cell match the rule

Implements Rule.

Definition at line 30 of file matrixrule.cpp.

References Cell::getNeighbour(), Cell::getState(), Rule::m_currentCellPossibleValues, and m_matrix.

7.8.3.4 toJson()

```
QJsonObject MatrixRule::toJson ( ) const  [virtual]
```

Return a QJsonObject to save the rule.

Implements Rule.

Definition at line 82 of file matrixrule.cpp.

References m_matrix, and Rule::toJson().

7.8.4 Member Data Documentation

7.8.4.1 m_matrix

```
QMap<QVector<short>, QVector<unsigned int> > MatrixRule::m_matrix  [protected]
```

Key correspond to relative position and the value to matchable states.

Definition at line 28 of file matrixrule.h.

Referenced by addNeighbourState(), matchCell(), and toJson().

The documentation for this class was generated from the following files:

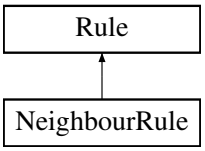
- matrixrule.h
- matrixrule.cpp

7.9 NeighbourRule Class Reference

Contains the rule condition and the output state if that condition is satisfied The rule modifies a cell depending on the number of its neighbours belonging to a range.

`#include <neighbourrule.h>`

Inheritance diagram for NeighbourRule:



Public Member Functions

- NeighbourRule (unsigned int outputState, QVector< unsigned int > currentCellValues, QPair< unsigned int, unsigned int > intervalNbrNeighbour, QSet< unsigned int > neighbourValues=QSet< unsigned int >())

  Constructs a neighbour rule with the parameters.
- ~NeighbourRule ()
- bool matchCell (const Cell *c) const

  Checks if the input cell satisfies the rule condition.
- QJsonObject toJson () const

  Return a QJsonObject to save the rule.

Protected Member Functions

- bool inInterval (unsigned int matchingNeighbours) const

  Checks if the number of neighbours matching the state condition belongs to the condition interval.

Protected Attributes

- QPair< unsigned int, unsigned int > m_neighbourInterval

  Stores the rule condition regarding the number of neighbours.
- QSet< unsigned int > m_neighbourPossibleValues

  Stores the possible values of the neighbours to fit with the rule.

7.9.1 Detailed Description

Contains the rule condition and the output state if that condition is satisfied The rule modifies a cell depending on the number of its neighbours belonging to a range.

Definition at line 13 of file neighbourrule.h.

7.9.2 Constructor & Destructor Documentation

7.9.2.1 NeighbourRule()

```
NeighbourRule::NeighbourRule (
            unsigned int outputState,
            QVector< unsigned int > currentCellValues,
            QPair< unsigned int, unsigned int > intervalNbrNeighbour,
            QSet< unsigned int > neighbourValues = QSet<unsigned int>() )
```

Constructs a neighbour rule with the parameters.

Definition at line 95 of file neighbourrule.cpp.

References m_neighbourInterval.

7.9.2.2 ~NeighbourRule()

```
NeighbourRule::~NeighbourRule ( )
```

Definition at line 104 of file neighbourrule.cpp.

7.9.3 Member Function Documentation

7.9.3.1 inInterval()

```
bool NeighbourRule::inInterval (
            unsigned int matchingNeighbours ) const  [protected]
```

Checks if the number of neighbours matching the state condition belongs to the condition interval.

Parameters

matchingNeighbours	Number of neighbours matching the rule condition regarding their values

Returns

True if the number of neighbours matches with the interval condition

Definition at line 84 of file neighbourrule.cpp.

References m_neighbourInterval.

Referenced by matchCell().

7.9.3.2 matchCell()

```
bool NeighbourRule::matchCell (
            const Cell * c ) const  [virtual]
```

Checks if the input cell satisfies the rule condition.

Parameters

c	current cell

Returns

True if the cell matches the rule condition

Implements Rule.

Definition at line 115 of file neighbourrule.cpp.

References Cell::countNeighbours(), Cell::getState(), inInterval(), Rule::m_currentCellPossibleValues, and m_neighbourPossibleValues.

7.9.3.3 toJson()

```
QJsonObject NeighbourRule::toJson ( ) const  [virtual]
```

Return a QJsonObject to save the rule.

Implements Rule.

Definition at line 146 of file neighbourrule.cpp.

References m_neighbourInterval, m_neighbourPossibleValues, and Rule::toJson().

7.9.4 Member Data Documentation

7.9.4.1 m_neighbourInterval

```
QPair<unsigned int , unsigned int> NeighbourRule::m_neighbourInterval  [protected]
```

Stores the rule condition regarding the number of neighbours.

Definition at line 16 of file neighbourrule.h.

Referenced by inInterval(), NeighbourRule(), and toJson().

7.9.4.2 m_neighbourPossibleValues

```
QSet<unsigned int> NeighbourRule::m_neighbourPossibleValues  [protected]
```

Stores the possible values of the neighbours to fit with the rule.

Definition at line 18 of file neighbourrule.h.

Referenced by matchCell(), and toJson().

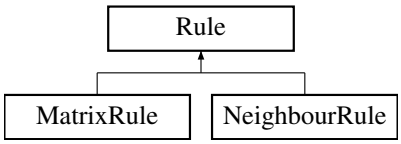
The documentation for this class was generated from the following files:

- neighbourrule.h
- neighbourrule.cpp

7.10 Rule Class Reference

```
#include <rule.h>
```

Inheritance diagram for Rule:



Public Member Functions

- Rule (QVector< unsigned int > currentCellValues, unsigned int outputState)

  Constructor of Rule.
- virtual QJsonObject toJson () const =0

  Create a QJsonObject for the current rule.
- virtual ~Rule ()
- virtual bool matchCell (const Cell *c) const =0

  Verify if the cell match the rule.
- unsigned int getCellOutputState () const

  Get the rule output state that will be the next state if the cell matches the rule condition.

Protected Attributes

- QVector< unsigned int > m_currentCellPossibleValues

  Stores the possible values of the current cell as part of the rule condition.
- unsigned int m_cellOutputState

  Stores the output state of the cell if the condition is matched.

7.10.1 Detailed Description

Definition at line 13 of file rule.h.

7.10.2 Constructor & Destructor Documentation

7.10.2.1 Rule()

```
Rule::Rule (
            QVector< unsigned int > currentCellValues,
            unsigned int outputState )
```

Constructor of Rule.

Parameters

currentCellValues	List of possibles values for the current cell
outputState	Next cell state

Definition at line 7 of file rule.cpp.

7.10.2.2 ~Rule()

```
virtual Rule::~Rule ( )  [inline], [virtual]
```

Definition at line 22 of file rule.h.

7.10.3 Member Function Documentation

7.10.3.1 getCellOutputState()

```
unsigned int Rule::getCellOutputState ( ) const
```

Get the rule output state that will be the next state if the cell matches the rule condition.

Definition at line 32 of file rule.cpp.

References m_cellOutputState.

7.10.3.2 matchCell()

```
virtual bool Rule::matchCell (
            const Cell * c ) const  [pure virtual]
```

Verify if the cell match the rule.

Using :

```
if (rule.matchCell(&cell))
    cell.setState(rule.getCellOutputState());
```

Parameters

c	Cell to test

Implemented in NeighbourRule, and MatrixRule.

7.10.3.3 toJson()

```
QJsonObject Rule::toJson ( ) const  [pure virtual]
```

Create a QJsonObject for the current rule.

Implemented in NeighbourRule, and MatrixRule.

Definition at line 15 of file rule.cpp.

References m_cellOutputState, and m_currentCellPossibleValues.

Referenced by MatrixRule::toJson(), and NeighbourRule::toJson().

7.10.4 Member Data Documentation

7.10.4.1 m_cellOutputState

```
unsigned int Rule::m_cellOutputState  [protected]
```

Stores the output state of the cell if the condition is matched.

Definition at line 17 of file rule.h.

Referenced by getCellOutputState(), and toJson().

7.10.4.2 m_currentCellPossibleValues

```
QVector<unsigned int> Rule::m_currentCellPossibleValues  [protected]
```

Stores the possible values of the current cell as part of the rule condition.

Definition at line 16 of file rule.h.

Referenced by MatrixRule::matchCell(), NeighbourRule::matchCell(), and toJson().

The documentation for this class was generated from the following files:

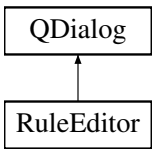
- rule.h
- rule.cpp

7.11 RuleEditor Class Reference

Dialog for editing the rules.

```
#include <ruleeditor.h>
```

Inheritance diagram for RuleEditor:



Public Slots

- void removeRule ()
  Remove the selected rule.
- void addRule ()
  Add the rule contained in the fields.
- void importFile ()
  Import a rule file.
- void sendRules ()
  Action when we click sur "Done".

Signals

- void rulesFilled (QList< const Rule *> rules)
- void fileImported (QString path)

Public Member Functions

- RuleEditor (unsigned int dimensions, QWidget *parent=nullptr)
  Constructor of the dialog for rule creation.

Private Attributes

- QList< const Rule * > m_rules
- QListWidget * m_rulesListWidget
- QTableWidget * m_rulesTable
- QSpinBox * m_outputStateBox
- QLineEdit * m_currentStatesEdit
- QLineEdit * m_neighbourStatesEdit
- QSpinBox * m_upperNeighbourBox
- QSpinBox * m_lowerNeighbourBox
- QSpinBox * m_automatonNumber
- QPushButton * m_addBt
- QPushButton * m_doneBt
- QPushButton * m_removeBt
- QPushButton * m_importBt
- unsigned int m_selectedRule
- unsigned int m_dimensions

  Dimensions of the automaton, to manage 1D dimensions.

7.11.1 Detailed Description

Dialog for editing the rules.

Definition at line 9 of file ruleeditor.h.

7.11.2 Constructor & Destructor Documentation

7.11.2.1 RuleEditor()

```
RuleEditor::RuleEditor (
            unsigned int dimensions,
            QWidget * parent = nullptr )  [explicit]
```

Constructor of the dialog for rule creation.

Parameters

dimensions	Dimensions of the created automaton

Definition at line 6 of file ruleeditor.cpp.

References addRule(), importFile(), m_addBt, m_automatonNumber, m_currentStatesEdit, m_dimensions, m_doneBt, m_importBt, m_lowerNeighbourBox, m_neighbourStatesEdit, m_outputStateBox, m_removeBt, m_rulesListWidget, m_selectedRule, m_upperNeighbourBox, removeRule(), and sendRules().

7.11.3 Member Function Documentation

7.11.3.1 addRule

```
void RuleEditor::addRule ( )  [slot]
```

Add the rule contained in the fields.

Definition at line 89 of file ruleeditor.cpp.

References m_currentStatesEdit, m_lowerNeighbourBox, m_neighbourStatesEdit, m_outputStateBox, m_rules, m_rulesListWidget, and m_upperNeighbourBox.

Referenced by RuleEditor().

7.11.3.2 fileImported

```
void RuleEditor::fileImported (
            QString path )  [signal]
```

Referenced by importFile().

7.11.3.3 importFile

```
void RuleEditor::importFile ( )  [slot]
```

Import a rule file.

Definition at line 137 of file ruleeditor.cpp.

References fileImported().

Referenced by RuleEditor().

7.11.3.4 removeRule

```
void RuleEditor::removeRule ( )  [slot]
```

Remove the selected rule.

Definition at line 114 of file ruleeditor.cpp.

References m_rules, and m_rulesListWidget.

Referenced by RuleEditor().

7.11.3.5 rulesFilled

```
void RuleEditor::rulesFilled (
            QList< const Rule *> rules )  [signal]
```

Referenced by sendRules().

7.11.3.6 sendRules

```
void RuleEditor::sendRules ( )  [slot]
```

Action when we click sur "Done".

Definition at line 121 of file ruleeditor.cpp.

References generate1DRules(), m_automatonNumber, m_dimensions, m_rules, and rulesFilled().

Referenced by RuleEditor().

7.11.4 Member Data Documentation

7.11.4.1 m_addBt

```
QPushButton* RuleEditor::m_addBt  [private]
```

Definition at line 23 of file ruleeditor.h.

Referenced by RuleEditor().

7.11.4.2 m_automatonNumber

```
QSpinBox* RuleEditor::m_automatonNumber  [private]
```

Definition at line 21 of file ruleeditor.h.

Referenced by RuleEditor(), and sendRules().

7.11.4.3 m_currentStatesEdit

```
QLineEdit* RuleEditor::m_currentStatesEdit  [private]
```

Definition at line 17 of file ruleeditor.h.

Referenced by addRule(), and RuleEditor().

7.11.4.4 m_dimensions

```
unsigned int RuleEditor::m_dimensions  [private]
```

Dimensions of the automaton, to manage 1D dimensions.

Definition at line 29 of file ruleeditor.h.

Referenced by RuleEditor(), and sendRules().

7.11.4.5 m_doneBt

```
QPushButton* RuleEditor::m_doneBt  [private]
```

Definition at line 24 of file ruleeditor.h.

Referenced by RuleEditor().

7.11.4.6 m_importBt

```
QPushButton* RuleEditor::m_importBt  [private]
```

Definition at line 26 of file ruleeditor.h.

Referenced by RuleEditor().

7.11.4.7 m_lowerNeighbourBox

```
QSpinBox* RuleEditor::m_lowerNeighbourBox  [private]
```

Definition at line 20 of file ruleeditor.h.

Referenced by addRule(), and RuleEditor().

7.11.4.8 m_neighbourStatesEdit

```
QLineEdit* RuleEditor::m_neighbourStatesEdit  [private]
```

Definition at line 18 of file ruleeditor.h.

Referenced by addRule(), and RuleEditor().

7.11.4.9 m_outputStateBox

```
QSpinBox* RuleEditor::m_outputStateBox  [private]
```

Definition at line 16 of file ruleeditor.h.

Referenced by addRule(), and RuleEditor().

7.11.4.10 m_removeBt

```
QPushButton* RuleEditor::m_removeBt  [private]
```

Definition at line 25 of file ruleeditor.h.

Referenced by RuleEditor().

7.11.4.11 m_rules

```
QList<const Rule*> RuleEditor::m_rules  [private]
```

Definition at line 12 of file ruleeditor.h.

Referenced by addRule(), removeRule(), and sendRules().

7.11.4.12 m_rulesListWidget

```
QListWidget* RuleEditor::m_rulesListWidget  [private]
```

Definition at line 13 of file ruleeditor.h.

Referenced by addRule(), removeRule(), and RuleEditor().

7.11.4.13 m_rulesTable

```
QTableWidget* RuleEditor::m_rulesTable  [private]
```

Definition at line 14 of file ruleeditor.h.

7.11.4.14 m_selectedRule

```
unsigned int RuleEditor::m_selectedRule  [private]
```

Definition at line 28 of file ruleeditor.h.

Referenced by RuleEditor().

7.11.4.15 m_upperNeighbourBox

```
QSpinBox* RuleEditor::m_upperNeighbourBox  [private]
```

Definition at line 19 of file ruleeditor.h.

Referenced by addRule(), and RuleEditor().

The documentation for this class was generated from the following files:

- ruleeditor.h
- ruleeditor.cpp

Chapter 8

File Documentation

8.1 automate.cpp File Reference

```
#include "automate.h"
```

Functions

- QList< const Rule * > generate1DRules (unsigned int automatonNumber)

  Generate the rules which corresponds to the automaton number.
- const MatrixRule * getRuleFromNumber (int previousConfiguration, int nextState)

  Create a rule from previous configuration and the next state.

8.1.1 Function Documentation

8.1.1.1 generate1DRules()

```
QList<const Rule *> generate1DRules (
            unsigned int automatonNumber )
```

Generate the rules which corresponds to the automaton number.

Parameters

automatonNumber	Number of the automaton (in [0, 255])

Returns

List of rule pointers

Definition at line 320 of file automate.cpp.

References getRuleFromNumber().

Referenced by RuleEditor::sendRules().

8.1.1.2 getRuleFromNumber()

```
const MatrixRule* getRuleFromNumber (
            int previousConfiguration,
            int nextState )
```

Create a rule from previous configuration and the next state.

Parameters

previousConfiguration	Previous states (left neighbour, cell and right neighbour)
nextState	Next state of the Cell

Returns

New rule

Definition at line 348 of file automate.cpp.

References MatrixRule::addNeighbourState().

Referenced by generate1DRules().

8.2 automate.cpp

```
00001 #include "automate.h"
00002
00007 bool Automate::loadRules(const QJsonArray &json)
00008 {
00009
00010     for (QJsonArray::const_iterator it = json.begin(); it != json.end(); ++it)
00011     {
00012         if (!it->isObject())
00013             return false;
00014         QJsonObject ruleJson = it->toObject();
00015
00016         if (!ruleJson.contains("type") || !ruleJson["type"].isString())
00017             return false;
00018         if (!ruleJson.contains("finalState") || !ruleJson["finalState"].isDouble())
00019             return false;
00020         if (!ruleJson.contains("currentStates") || !ruleJson["currentStates"].isArray())
00021             return false;
00022
00023         QVector<unsigned int> currentStates;
00024         QJsonArray statesJson = ruleJson["currentStates"].toArray();
00025         for (int i = 0; i < statesJson.size(); i++)
00026         {
00027             if (!statesJson.at(i).isDouble())
00028                 return false;
00029             currentStates.push_back(statesJson.at(i).toInt());
00030         }
00031
00032         if (!ruleJson["type"].toString().compare("neighbour", Qt::CaseInsensitive))
00033         {
00034             if (!ruleJson.contains("neighbourNumberMin") || !ruleJson["neighbourNumberMin"].isDouble())
00035                 return false;
```

```
00036             if (!ruleJson.contains("neighbourNumberMax") || !ruleJson["neighbourNumberMax"].isDouble())
00037                 return false;
00038
00039
00040
00041             QPair<unsigned int, unsigned int> nbrNeighbourInterval(ruleJson["neighbourNumberMin"].toInt(),
      ruleJson["neighbourNumberMax"].toInt());
00042             NeighbourRule *newRule;
00043             if (ruleJson.contains("neighbourStates"))
00044             {
00045                 if (!ruleJson["neighbourStates"].isArray())
00046                     return false;
00047                 QSet<unsigned int> neighbourStates;
00048
00049                 QJsonArray statesJson = ruleJson["neighbourStates"].toArray();
00050                 for (int i = 0; i < statesJson.size(); i++)
00051                 {
00052                     if (!statesJson.at(i).isDouble())
00053                         return false;
00054                     neighbourStates.insert(statesJson.at(i).toInt());
00055                 }
00056                 newRule = new NeighbourRule((unsigned int)ruleJson["finalState"].toInt(),
      currentStates, nbrNeighbourInterval, neighbourStates);
00057             }
00058             else
00059                 newRule = new NeighbourRule((unsigned int)ruleJson["finalState"].toInt(),
      currentStates, nbrNeighbourInterval);
00060             m_rules.push_back(newRule);
00061         }
00062         else if (!ruleJson["type"].toString().compare("matrix", Qt::CaseInsensitive))
00063         {
00064             MatrixRule *newRule = new MatrixRule((unsigned int)ruleJson["finalState"].
      toInt(), currentStates);
00065             if (ruleJson.contains("neighbours"))
00066             {
00067                 if (!ruleJson["neighbours"].isArray())
00068                     return false;
00069                 QJsonArray neighboursJson = ruleJson["neighbours"].toArray();
00070                 for (int i = 0; i < neighboursJson.size(); i++)
00071                 {
00072                     if (!neighboursJson.at(i).isObject())
00073                         return false;
00074
00075                     if (!neighboursJson.at(i).toObject().contains("relativePosition") || !neighboursJson.at
      (i).toObject()["relativePosition"].isArray())
00076                         return false;
00077                     if (!neighboursJson.at(i).toObject().contains("neighbourStates") || !neighboursJson.at(
      i).toObject()["neighbourStates"].isArray())
00078                         return false;
00079
00080                     QVector<unsigned int> neighbourStates;
00081
00082
00083                     QJsonArray statesJson = neighboursJson.at(i).toObject()["neighbourStates"].toArray();
00084                     for (int j = 0; j < statesJson.size(); j++)
00085                     {
00086                         if (!statesJson.at(j).isDouble())
00087                             return false;
00088                         neighbourStates.push_back(statesJson.at(j).toInt());
00089                     }
00090
00091                     QVector<short> relativePosition;
00092                     QJsonArray positionJson = neighboursJson.at(i).toObject()["relativePosition"].toArray()
      ;
00093                     for (int j = 0; j < positionJson.size(); j++)
00094                     {
00095                         if (!positionJson.at(j).isDouble())
00096                             return false;
00097                         relativePosition.push_back(positionJson.at(j).toInt());
00098                     }
00099                     if (relativePosition.size() != m_cellHandler->
      getDimensions().size())
00100                         return false;
00101                     newRule->addNeighbourState(relativePosition, neighbourStates);
00102                 }
00103
00104             }
00105             m_rules.push_back(newRule);
00106
00107
00108         }
00109         else
00110             return false;
00111
00112     }
00113     return true;
00114 }
```

```
00115
00120 Automate::Automate(QString cellHandlerFilename)
00121 {
00122     m_cellHandler = new CellHandler(cellHandlerFilename);
00123
00124 }
00125
00133 Automate::Automate(const QVector<unsigned int> dimensions,
      CellHandler::generationTypes type, unsigned int stateMax, unsigned int density)
00134 {
00135     m_cellHandler = new CellHandler(dimensions, type, stateMax, density);
00136
00137 }
00138
00144 Automate::Automate(QString cellHandlerFilename, QString ruleFilename)
00145 {
00146     m_cellHandler = new CellHandler(cellHandlerFilename);
00147
00148     QFile ruleFile(ruleFilename);
00149     if (!ruleFile.open(QIODevice::ReadOnly | QIODevice::Text)) {
00150         qWarning("Couldn't open given file.");
00151         throw QString(QObject::tr("Couldn't open given file"));
00152     }
00153
00154     QJsonParseError parseErr;
00155     QJsonDocument loadDoc(QJsonDocument::fromJson(ruleFile.readAll(), &parseErr));
00156
00157     ruleFile.close();
00158
00159
00160     if (loadDoc.isNull() || loadDoc.isEmpty())
00161     {
00162         qWarning() << "Could not read data : ";
00163         qWarning() << parseErr.errorString();
00164         throw QString(parseErr.errorString());
00165     }
00166
00167     if (!loadDoc.isArray())
00168     {
00169         qWarning() << "We need an array of rules !";
00170         throw QString(QObject::tr("We need an array of rules!"));
00171     }
00172
00173     loadRules(loadDoc.array());
00174
00175 }
00176
00179 Automate::~Automate()
00180 {
00181     delete m_cellHandler;
00182     for (QList<const Rule*>::iterator it = m_rules.begin(); it != m_rules.end(); ++it)
00183     {
00184
00185         delete *it;
00186     }
00187 }
00188
00192 bool Automate::saveRules(QString filename) const
00193 {
00194     QFile ruleFile(filename);
00195     if (!ruleFile.open(QIODevice::WriteOnly | QIODevice::Text)) {
00196         qWarning("Couldn't open given file.");
00197         throw QString(QObject::tr("Couldn't open given file"));
00198     }
00199
00200     QJsonArray array;
00201
00202     for (QList<const Rule*>::const_iterator it = m_rules.cbegin(); it !=
      m_rules.cend(); ++it)
00203         array.append((*it)->toJson());
00204
00205     QJsonDocument doc(array);
00206
00207     ruleFile.write(doc.toJson());
00208
00209     return true;
00210 }
00211
00214 bool Automate::saveCells(QString filename) const
00215 {
00216     if (m_cellHandler != nullptr)
00217         return m_cellHandler->save(filename);
00218     return false;
00219 }
00220
00223 bool Automate::saveAll(QString cellHandlerFilename, QString rulesFilename) const
00224 {
```

```
00225     return saveRules(rulesFilename) && saveCells(cellHandlerFilename);
00226 }
00227
00230 void Automate::addRule(const Rule *newRule)
00231 {
00232     m_rules.push_back(newRule);
00233 }
00234
00241 void Automate::setRulePriority(const Rule *rule, unsigned int newPlace)
00242 {
00243     m_rules.move(m_rules.indexOf(rule), newPlace);
00244 }
00245
00248 const QList<const Rule *> &Automate::getRules() const
00249 {
00250    return m_rules;
00251 }
00252
00257 bool Automate::run(unsigned int nbSteps) //void instead ?
00258 {
00259     for(unsigned int i = 0; i<nbSteps; ++i)
00260     {
00261         for (CellHandler::iterator it = m_cellHandler->
      begin(); it != m_cellHandler->end(); ++it)
00262         {
00263             for (QList<const Rule*>::iterator rule = m_rules.begin(); rule !=
      m_rules.end() ; ++rule)
00264             {
00265                 if((*rule)->matchCell(*it)) //if the cell matches with the rule, its state is changed
00266                 {
00267                     it->setState((*rule)->getCellOutputState());
00268                     break;
00269                 }
00270             }
00271
00272
00273         }
00274         m_cellHandler->nextStates(); //apply the changes to all the cells
       simultaneously
00275     }
00276     return true;
00277
00278 }
00279
00282 const CellHandler &Automate::getCellHandler() const
00283 {
00284     return *m_cellHandler;
00285 }
00286
00287 void Automate::addRuleFile(QString filename){
00288     QFile ruleFile(filename);
00289     if (!ruleFile.open(QIODevice::ReadOnly | QIODevice::Text)) {
00290         qWarning("Couldn't open given file.");
00291         throw QString(QObject::tr("Couldn't open given file"));
00292     }
00293
00294     QJsonParseError parseErr;
00295     QJsonDocument loadDoc(QJsonDocument::fromJson(ruleFile.readAll(), &parseErr));
00296
00297     ruleFile.close();
00298
00299
00300     if (loadDoc.isNull() || loadDoc.isEmpty())
00301     {
00302         qWarning() << "Could not read data : ";
00303         qWarning() << parseErr.errorString();
00304         throw QString(parseErr.errorString());
00305     }
00306
00307     if (!loadDoc.isArray())
00308     {
00309         qWarning() << "We need an array of rules !";
00310         throw QString(QObject::tr("We need an array of rules!"));
00311     }
00312
00313     loadRules(loadDoc.array());
00314 }
00315
00320 QList<const Rule *> generate1DRules(unsigned int automatonNumber)
00321 {
00322     if (automatonNumber > 256) throw QString(QObject::tr("Automaton number not defined"));
00323     QList<const Rule*> ruleList;
00324     unsigned short int p = 128;
00325     int i = 7;
00326     while (i >= 0) {
00327         if (automatonNumber >= p)
00328         {
```

```
00329             ruleList.push_back((Rule*)getRuleFromNumber(i, 1));
00330             //numeroBit.push_back('1');
00331             automatonNumber -= p;
00332         }
00333         else {
00334             ruleList.push_back((Rule*)getRuleFromNumber(i, 0));
00335         }
00336         i--;
00337         p = p / 2;
00338     }
00339
00340     return ruleList;
00341 }
00342
00348 const MatrixRule* getRuleFromNumber(int previousConfiguration, int nextState)
00349 {
00350     if (previousConfiguration > 7 || previousConfiguration < 0)
00351         throw QString(QObject::tr("Configuration not possible"));
00352
00353     MatrixRule* newRule;
00354     switch(previousConfiguration)
00355     {
00356         case 0: // 000
00357             newRule = new MatrixRule(nextState, {0});
00358             newRule->addNeighbourState(QVector<short>{-1}, 0);
00359             newRule->addNeighbourState(QVector<short>{1}, 0);
00360         break;
00361     case 1: // 001
00362         newRule = new MatrixRule(nextState, {0});
00363         newRule->addNeighbourState(QVector<short>{-1}, 0);
00364         newRule->addNeighbourState(QVector<short>{1}, 1);
00365     break;
00366     case 2: // 010
00367         newRule = new MatrixRule(nextState, {1});
00368         newRule->addNeighbourState(QVector<short>{-1}, 0);
00369         newRule->addNeighbourState(QVector<short>{1}, 0);
00370     break;
00371     case 3: // 011
00372         newRule = new MatrixRule(nextState, {1});
00373         newRule->addNeighbourState(QVector<short>{-1}, 0);
00374         newRule->addNeighbourState(QVector<short>{1}, 1);
00375     break;
00376     case 4: // 100
00377         newRule = new MatrixRule(nextState, {0});
00378         newRule->addNeighbourState(QVector<short>{-1}, 1);
00379         newRule->addNeighbourState(QVector<short>{1}, 0);
00380     break;
00381     case 5: // 101
00382         newRule = new MatrixRule(nextState, {0});
00383         newRule->addNeighbourState(QVector<short>{-1}, 1);
00384         newRule->addNeighbourState(QVector<short>{1}, 1);
00385     break;
00386     case 6: // 110
00387         newRule = new MatrixRule(nextState, {1});
00388         newRule->addNeighbourState(QVector<short>{-1}, 1);
00389         newRule->addNeighbourState(QVector<short>{1}, 0);
00390     break;
00391     case 7: // 111
00392         newRule = new MatrixRule(nextState, {1});
00393         newRule->addNeighbourState(QVector<short>{-1}, 1);
00394         newRule->addNeighbourState(QVector<short>{1}, 1);
00395     break;
00396     }
00397
00398     return newRule;
00399 }
00400
```

8.3 automate.h File Reference

```
#include <QVector>
#include <QList>
#include "cellhandler.h"
#include "rule.h"
#include "neighbourrule.h"
#include "matrixrule.h"
```

Classes

- class Automate

  Manage the application of rules on the cells.

Functions

- QList< const Rule * > generate1DRules (unsigned int automatonNumber)

  Generate the rules which corresponds to the automaton number.
- const MatrixRule * getRuleFromNumber (int previousConfiguration, int nextState)

  Create a rule from previous configuration and the next state.

8.3.1 Function Documentation

8.3.1.1 generate1DRules()

```
QList<const Rule*> generate1DRules (
            unsigned int automatonNumber )
```

Generate the rules which corresponds to the automaton number.

Parameters

automatonNumber	Number of the automaton (in [0, 255])

Returns

List of rule pointers

Definition at line 320 of file automate.cpp.

References getRuleFromNumber().

Referenced by RuleEditor::sendRules().

8.3.1.2 getRuleFromNumber()

```
const MatrixRule* getRuleFromNumber (
            int previousConfiguration,
            int nextState )
```

Create a rule from previous configuration and the next state.

Parameters

previousConfiguration	Previous states (left neighbour, cell and right neighbour)
nextState	Next state of the Cell

Returns

New rule

Definition at line 348 of file automate.cpp.

References MatrixRule::addNeighbourState().

Referenced by generate1DRules().

8.4 automate.h

```
00001 #ifndef AUTOMATE_H
00002 #define AUTOMATE_H
00003 #include <QVector>
00004 #include <QList>
00005
00006 #include "cellhandler.h"
00007 #include "rule.h"
00008 #include "neighbourrule.h"
00009 #include "matrixrule.h"
00010
00011
00015 class Automate
00016 {
00017 private:
00018     CellHandler* m_cellHandler = nullptr;
00019     QList<const Rule*> m_rules;
00020     friend class AutomateHandler;
00021
00022     bool loadRules(const QJsonArray &json);
00023 public:
00024     Automate(QString filename);
00025     Automate(const QVector<unsigned int> dimensions,
      CellHandler::generationTypes type =
      CellHandler::empty, unsigned int stateMax = 1, unsigned int density = 20);
00026     Automate(QString cellHandlerFilename, QString ruleFilename);
00027     virtual ~Automate();
00028
00029     bool saveRules(QString filename) const ;
00030     bool saveCells(QString filename) const ;
00031     bool saveAll(QString cellHandlerFilename, QString rulesFilename)const ;
00032
00033     void addRuleFile(QString filename);
00034     void addRule(const Rule* newRule);
00035     void setRulePriority(const Rule* rule, unsigned int newPlace);
00036     const QList<const Rule *> &getRules() const;
00037
00038
00039
00040 public:
00041     bool run(unsigned int nbSteps = 1);
00042     const CellHandler& getCellHandler() const;
00043 };
00044
00045 QList<const Rule*> generate1DRules(unsigned int automatonNumber);
00046 const MatrixRule *getRuleFromNumber(int previousConfiguration, int nextState);
00047
00048 #endif // AUTOMATE_H
```

8.5 automatehandler.cpp File Reference

```
#include "automatehandler.h"
```

8.6 automatehandler.cpp

```
00001 #include "automatehandler.h"
00002
00005 AutomateHandler * AutomateHandler::m_activeAutomateHandler
       = nullptr;
00006
00007
00010 AutomateHandler::AutomateHandler()
00011 {
00012
00013 }
00014
00015
00018 AutomateHandler::~AutomateHandler()
00019 {
00020     while(!m_ActiveAutomates.empty())
00021         delete(m_ActiveAutomates.first());
00022 }
00023
00024
00029 AutomateHandler & AutomateHandler::getAutomateHandler()
00030 {
00031     if (!m_activeAutomateHandler)
00032         m_activeAutomateHandler = new AutomateHandler;
00033     return *m_activeAutomateHandler;
00034 }
00035
00036
00039 void AutomateHandler::deleteAutomateHandler()
00040 {
00041     if(m_activeAutomateHandler)
00042     {
00043         delete m_activeAutomateHandler;
00044         m_activeAutomateHandler = nullptr;
00045     }
00046 }
00047
00048
00055 Automate * AutomateHandler::getAutomate(int indexAutomate){
00056     if(indexAutomate > m_ActiveAutomates.size())
00057         return nullptr;
00058     return m_ActiveAutomates.at(indexAutomate);
00059 }
00060
00061
00067 unsigned int AutomateHandler::getNumberAutomates()const
00068 {
00069     return m_ActiveAutomates.size();
00070 }
00071
00072
00078 void AutomateHandler::addAutomate(Automate * automate)
00079 {
00080     m_ActiveAutomates.append(automate);
00081 }
00082
00083
00089 void AutomateHandler::deleteAutomate(Automate * automate)
00090 {
00091     if(m_ActiveAutomates.contains(automate))
00092     {
00093         delete automate;
00094         m_ActiveAutomates.removeOne(automate);
00095     }
00096 }
```

8.7 automatehandler.h File Reference

```
#include "automate.h"
```

Classes

- class AutomateHandler

  Implementation of singleton design pattern to manage the Automates.

8.8 automatehandler.h

```
00001 #ifndef AUTOMATEHANDLER_H
00002 #define AUTOMATEHANDLER_H
00003
00004 #include "automate.h"
00005
00006
00010 class AutomateHandler
00011 {
00012 private:
00013     QList<Automate*> m_ActiveAutomates;
00014     static AutomateHandler * m_activeAutomateHandler;
00015
00016     AutomateHandler();
00017     AutomateHandler(const AutomateHandler & a) = delete;
00018     AutomateHandler & operator=(const AutomateHandler & a) = delete;
00019     ~AutomateHandler();
00020
00021 public:
00022     static AutomateHandler & getAutomateHandler();
00023     static void deleteAutomateHandler();
00024
00025     Automate * getAutomate(int indexAutomate);
00026     unsigned int getNumberAutomates()const;
00027
00028     void addAutomate(Automate * automate);
00029     void deleteAutomate(Automate * automate);
00030 };
00031
00032
00033 #endif // AUTOMATEHANDLER_H
```

8.9 cell.cpp File Reference

```
#include "cell.h"
```

8.10 cell.cpp

```
00001 #include "cell.h"
00002
00007 Cell::Cell(unsigned int state):
00008     m_nextState(state)
00009 {
00010     m_states.push(state);
00011 }
00012
00020 void Cell::setState(unsigned int state)
00021 {
00022     m_nextState = state;
00023 }
00024
00030 void Cell::validState()
00031 {
00032     m_states.push(m_nextState);
00033 }
00034
00041 void Cell::forceState(unsigned int state)
00042 {
00043     m_nextState = state;
00044     m_states.pop();
00045     m_states.push(m_nextState);
00046 }
00047
00050 unsigned int Cell::getState() const
00051 {
00052     return m_states.top();
00053 }
00054
00059 bool Cell::back()
00060 {
00061     if (m_states.size() <= 1)
```

```
00062         return false;
00063     m_states.pop();
00064     m_nextState = m_states.top();
00065     return true;
00066 }
00067
00070 void Cell::reset()
00071 {
00072     while (m_states.size() > 1)
00073         m_states.pop();
00074     m_nextState = m_states.top();
00075 }
00076
00084 bool Cell::addNeighbour(const Cell* neighbour, const QVector<short> relativePosition)
00085 {
00086     if (m_neighbours.count(relativePosition))
00087         return false;
00088
00089     m_neighbours.insert(relativePosition, neighbour);
00090     return true;
00091 }
00092
00097 QMap<QVector<short>, const Cell *> Cell::getNeighbours() const
00098 {
00099     return m_neighbours;
00100 }
00101
00104 const Cell *Cell::getNeighbour(QVector<short> relativePosition) const
00105 {
00106     return m_neighbours.value(relativePosition, nullptr);
00107 }
00108
00111 unsigned int Cell::countNeighbours(unsigned int filterState) const
00112 {
00113     unsigned int count = 0;
00114     for (QMap<QVector<short>, const Cell*>::const_iterator it = m_neighbours.begin(); it !=
      m_neighbours.end(); ++it)
00115     {
00116         if ((*it)->getState() == filterState)
00117             count++;
00118     }
00119     return count;
00120 }
00121
00124 unsigned int Cell::countNeighbours() const
00125 {
00126     unsigned int count = 0;
00127     for (QMap<QVector<short>, const Cell*>::const_iterator it = m_neighbours.begin(); it !=
      m_neighbours.end(); ++it)
00128     {
00129         if ((*it)->getState() != 0)
00130             count++;
00131     }
00132     return count;
00133 }
00134
00141 QVector<short> Cell::getRelativePosition(const QVector<unsigned int> cellPosition,
      const QVector<unsigned int> neighbourPosition)
00142 {
00143     if (cellPosition.size() != neighbourPosition.size())
00144     {
00145         throw QString(QObject::tr("Different size of position vectors"));
00146     }
00147     QVector<short> relativePosition;
00148     for (short i = 0; i < cellPosition.size(); i++)
00149         relativePosition.push_back(neighbourPosition.at(i) - cellPosition.at(i));
00150
00151     return relativePosition;
00152 }
```

8.11 cell.h File Reference

```
#include <QVector>
#include <QDebug>
#include <QStack>
```

Classes

- class Cell

  Contains the state, the next state and the neighbours.

8.12 cell.h

```
00001 #ifndef CELL_H
00002 #define CELL_H
00003
00004 #include <QVector>
00005 #include <QDebug>
00006 #include <QStack>
00007
00011 class Cell
00012 {
00013 public:
00014     Cell(unsigned int state = 0);
00015
00016     void setState(unsigned int state);
00017     void validState();
00018     void forceState(unsigned int state);
00019     unsigned int getState() const;
00020
00021     bool back();
00022     void reset();
00023
00024     bool addNeighbour(const Cell* neighbour, const QVector<short> relativePosition);
00025     QMap<QVector<short>, const Cell*> getNeighbours() const;
00026     const Cell* getNeighbour(QVector<short> relativePosition) const;
00027
00028     unsigned int countNeighbours(unsigned int filterState) const;
00029     unsigned int countNeighbours() const;
00030
00031     static QVector<short> getRelativePosition(const QVector<unsigned int> cellPosition,
      const QVector<unsigned int> neighbourPosition);
00032
00033 private:
00034     QStack<unsigned int> m_states;
00035     unsigned int m_nextState;
00036
00037     QMap<QVector<short>, const Cell*> m_neighbours;
00038 };
00039
00040 #endif // CELL_H
```

8.13 cellhandler.cpp File Reference

```
#include <iostream>
#include "cellhandler.h"
```

8.14 cellhandler.cpp

```
00001 #include <iostream>
00002 #include "cellhandler.h"
00003
00025 CellHandler::CellHandler(const QString filename)
00026 {
00027     QFile loadFile(filename);
00028     if (!loadFile.open(QIODevice::ReadOnly | QIODevice::Text)) {
00029         qWarning("Couldn't open given file.");
00030         throw QString(QObject::tr("Couldn't open given file"));
00031     }
00032
00033     QJsonParseError parseErr;
00034     QJsonDocument loadDoc(QJsonDocument::fromJson(loadFile.readAll(), &parseErr));
```

```
00035
00036     loadFile.close();
00037
00038
00039     if (loadDoc.isNull() || loadDoc.isEmpty()) {
00040         qWarning() << "Could not read data : ";
00041         qWarning() << parseErr.errorString();
00042         throw QString(parseErr.errorString());
00043     }
00044
00045     // Loadding of the json file
00046     if (!load(loadDoc.object()))
00047     {
00048         qWarning("File not valid");
00049         throw QString(QObject::tr("File not valid"));
00050     }
00051
00052     foundNeighbours();
00053
00054
00055 }
00056
00076 CellHandler::CellHandler(const QJsonObject& json)
00077 {
00078     if (!load(json))
00079     {
00080         qWarning("Json not valid");
00081         throw QString(QObject::tr("Json not valid"));
00082     }
00083
00084     foundNeighbours();
00085
00086 }
00087
00088
00098 CellHandler::CellHandler(const QVector<unsigned int> dimensions,
      generationTypes type, unsigned int stateMax, unsigned int density)
00099 {
00100     m_dimensions = dimensions;
00101     QVector<unsigned int> position;
00102     unsigned int size = 1;
00103
00104     // Set position vector to 0
00105
00106     for (unsigned short i = 0; i < m_dimensions.size(); i++)
00107     {
00108         position.push_back(0);
00109         size *= m_dimensions.at(i);
00110     }
00111
00112
00113     // Creation of cells
00114     for (unsigned int j = 0; j < size; j++)
00115     {
00116         m_cells.insert(position, new Cell(0));
00117
00118         positionIncrement(position);
00119     }
00120
00121     foundNeighbours();
00122
00123     if (type != empty)
00124         generate(type, stateMax, density);
00125
00126 }
00127
00130 CellHandler::~CellHandler()
00131 {
00132     for (QMap<QVector<unsigned int>, Cell* >::iterator it = m_cells.begin(); it !=
      m_cells.end(); ++it)
00133     {
00134         delete it.value();
00135     }
00136 }
00137
00140 Cell *CellHandler::getCell(const QVector<unsigned int> position) const
00141 {
00142     return m_cells.value(position);
00143 }
00144
00147 unsigned int CellHandler::getMaxState()
00148 {
00149     return QColor::colorNames().size()-2;
00150 }
00151
00154 QVector<unsigned int> CellHandler::getDimensions() const
00155 {
```

```
00156     return m_dimensions;
00157 }
00158
00161 void CellHandler::nextStates() const
00162 {
00163     for (QMap<QVector<unsigned int>, Cell* >::const_iterator it =
      m_cells.begin(); it != m_cells.end(); ++it)
00164     {
00165         it.value()->validState();
00166     }
00167 }
00168
00171 bool CellHandler::previousStates() const
00172 {
00173     for (QMap<QVector<unsigned int>, Cell* >::const_iterator it =
      m_cells.begin(); it != m_cells.end(); ++it)
00174     {
00175         if (!it.value()->back())
00176             return false;
00177     }
00178     return true;
00179 }
00180
00183 void CellHandler::reset() const
00184 {
00185     for (QMap<QVector<unsigned int>, Cell* >::const_iterator it =
      m_cells.begin(); it != m_cells.end(); ++it)
00186     {
00187         it.value()->reset();
00188     }
00189 }
00190
00198 bool CellHandler::save(QString filename) const
00199 {
00200     QFile saveFile(filename);
00201     if (!saveFile.open(QIODevice::WriteOnly)) {
00202         qWarning("Couldn't create or open given file.");
00203         throw QString(QObject::tr("Couldn't create or open given file"));
00204     }
00205
00206     QJsonObject json;
00207     QString stringDimension;
00208     // Creation of the dimension string
00209     for (int i = 0; i < m_dimensions.size(); i++)
00210     {
00211         if (i != 0)
00212             stringDimension.push_back("x");
00213         stringDimension.push_back(QString::number(m_dimensions.at(i)));
00214     }
00215     json["dimensions"] = QJsonValue(stringDimension);
00216
00217     QJsonArray cells;
00218     for (CellHandler::const_iterator it = begin(); it !=
      end(); ++it)
00219     {
00220         cells.append(QJsonValue((int)it->getState()));
00221     }
00222     json["cells"] = cells;
00223
00224     //json["maxState"] = QJsonValue((int)m_maxState);
00225
00226
00227     QJsonDocument saveDoc(json);
00228     saveFile.write(saveDoc.toJson());
00229
00230     saveFile.close();
00231     return true;
00232 }
00233
00240 void CellHandler::generate(CellHandler::generationTypes
      type, unsigned int stateMax, unsigned short density)
00241 {
00242     if (type == random)
00243     {
00244         QVector<unsigned int> position;
00245         for (unsigned short i = 0; i < m_dimensions.size(); i++)
00246         {
00247             position.push_back(0);
00248         }
00249         QRandomGenerator generator((float)qrand()*(float)time_t()/RAND_MAX);
00250         for (int j = 0; j < m_cells.size(); j++)
00251         {
00252             unsigned int state = 0;
00253             // 0 have (1-density)% of chance of being generate
00254             if (generator.generateDouble()*100.0 < density)
00255                 state = (float)(generator.generateDouble()*stateMax) +1;
00256             if (state > stateMax)
```

```
00257                 state = stateMax;
00258             m_cells.value(position)->forceState(state);
00259 
00260             positionIncrement(position);
00261         }
00262     }
00263     else if (type == symetric)
00264     {
00265         QVector<unsigned int> position;
00266         for (short i = 0; i < m_dimensions.size(); i++)
00267         {
00268             position.push_back(0);
00269         }
00270 
00271         QRandomGenerator generator((float)qrand()*(float)time_t()/RAND_MAX);
00272         QVector<unsigned int> savedStates;
00273         for (int j = 0; j < m_cells.size(); j++)
00274         {
00275             if (j % m_dimensions.at(0) == 0)
00276                 savedStates.clear();
00277             if (j % m_dimensions.at(0) < (m_dimensions.at(0)+1) / 2)
00278             {
00279                 unsigned int state = 0;
00280                 // 0 have (1-density)% of chance of being generate
00281                 if (generator.generateDouble()*100.0 < density)
00282                     state = (float)(generator.generateDouble()*stateMax) +1;
00283                 if (state > stateMax)
00284                     state = stateMax;
00285                 savedStates.push_back(state);
00286                 m_cells.value(position)->forceState(state);
00287             }
00288             else
00289             {
00290                 unsigned int i = savedStates.size() - (j % m_dimensions.at(0) - (
      m_dimensions.at(0)-1)/2 + (m_dimensions.at(0) % 2 == 0 ? 0 : 1));
00291                 m_cells.value(position)->forceState(savedStates.at(i));
00292             }
00293             positionIncrement(position);
00294 
00295 
00296         }
00297 
00298     }
00299 }
00300 
00305 void CellHandler::print(std::ostream &stream) const
00306 {
00307     for (const_iterator it = begin(); it != end(); ++it)
00308     {
00309         for (unsigned int d = 0; d < it.changedDimension(); d++)
00310             stream << std::endl;
00311         stream << it->getState() << " ";
00312 
00313     }
00314 
00315 }
00316 
00319 CellHandler::iterator CellHandler::begin()
00320 {
00321     return iterator(this);
00322 }
00323 
00326 CellHandler::const_iterator CellHandler::begin() const
00327 {
00328     return const_iterator(this);
00329 }
00330 
00335 bool CellHandler::end() const
00336 {
00337     return true;
00338 }
00339 
00370 bool CellHandler::load(const QJsonObject &json)
00371 {
00372     if (!json.contains("dimensions") || !json["dimensions"].isString())
00373         return false;
00374 
00375     // RegExp to validate dimensions field format : "10x10"
00376     QRegExpValidator dimensionValidator(QRegExp("([0-9]*x?)*"));
00377     QString stringDimensions = json["dimensions"].toString();
00378     int pos= 0;
00379     if (dimensionValidator.validate(stringDimensions, pos) != QRegExpValidator::Acceptable)
00380         return false;
00381 
00382     // Split of dimensions field : "10x10" => "10", "10"
00383     QRegExp rx("x");
00384     QStringList list = json["dimensions"].toString().split(rx, QString::SkipEmptyParts);
```

```
00385
00386     int product = 1;
00387     // Dimensions construction
00388     for (int i = 0; i < list.size(); i++)
00389     {
00390         product = product * list.at(i).toInt();
00391         m_dimensions.push_back(list.at(i).toInt());
00392     }
00393     if (!json.contains("cells") || !json["cells"].isArray())
00394         return false;
00395
00396     QJsonArray cells = json["cells"].toArray();
00397     if (cells.size() != product)
00398         return false;
00399
00400     QVector<unsigned int> position;
00401     // Set position vector to 0
00402     for (unsigned short i = 0; i < m_dimensions.size(); i++)
00403     {
00404         position.push_back(0);
00405     }
00406
00407
00408     // Creation of cells
00409     for (int j = 0; j < cells.size(); j++)
00410     {
00411         if (!cells.at(j).isDouble())
00412             return false;
00413         if (cells.at(j).toDouble() < 0)
00414             return false;
00415         m_cells.insert(position, new Cell(cells.at(j).toDouble()));
00416
00417         positionIncrement(position);
00418     }
00419
00420     //if (!json.contains("maxState") || !json["maxState"].isDouble())
00421     //    return false;
00422     //m_maxState = json["maxState"].toInt();
00423
00424     return true;
00425
00426 }
00427
00433 void CellHandler::foundNeighbours()
00434 {
00435     QVector<unsigned int> currentPosition;
00436     // Set position vector to 0
00437     for (unsigned short i = 0; i < m_dimensions.size(); i++)
00438     {
00439         currentPosition.push_back(0);
00440     }
00441     // Modification of all the cells
00442     for (int j = 0; j < m_cells.size(); j++)
00443     {
00444         // Get the list of the neighbours positions
00445         // This function is recursive
00446         QVector<QVector<unsigned int> > listPosition(getListNeighboursPositions(
      currentPosition));
00447
00448         // Adding neighbours
00449         for (int i = 0; i < listPosition.size(); i++)
00450             m_cells.value(currentPosition)->addNeighbour(m_cells.value(listPosition.at(i)),
      Cell::getRelativePosition(currentPosition, listPosition.at(i)));
00451         positionIncrement(currentPosition);
00452     }
00453
00454 }
00455
00463 void CellHandler::positionIncrement(QVector<unsigned int> &pos, unsigned int
      value) const
00464 {
00465     pos.replace(0, pos.at(0) + value); // adding the value to the first digit
00466
00467     // Carry management
00468     for (unsigned short i = 0; i < m_dimensions.size(); i++)
00469     {
00470         if (pos.at(i) >= m_dimensions.at(i) && pos.at(i) <
      m_dimensions.at(i)*2)
00471         {
00472             pos.replace(i, 0);
00473             if (i + 1 != m_dimensions.size())
00474                 pos.replace(i+1, pos.at(i+1)+1);
00475         }
00476         else if (pos.at(i) >= m_dimensions.at(i))
00477         {
00478             pos.replace(i, pos.at(i) - m_dimensions.at(i));
00479             if (i + 1 != m_dimensions.size())
```

```
00480                 pos.replace(i+1, pos.at(i+1)+1);
00481             i--;
00482         }
00483
00484     }
00485 }
00486
00492 QVector<QVector<unsigned int> >& CellHandler::getListNeighboursPositions
      (const QVector<unsigned int> position) const
00493 {
00494     QVector<QVector<unsigned int> > *list = getListNeighboursPositionsRecursive
      (position, position.size(), position);
00495     // We remove the position of the cell
00496     list->removeAll(position);
00497     return *list;
00498 }
00499
00533 QVector<QVector<unsigned int> >*
      CellHandler::getListNeighboursPositionsRecursive(const
      QVector<unsigned int> position, unsigned int dimension, QVector<unsigned int> lastAdd) const
00534 {
00535     if (dimension == 0) // Stop condition
00536     {
00537         QVector<QVector<unsigned int> > *list = new QVector<QVector<unsigned int> >;
00538         return list;
00539     }
00540     QVector<QVector<unsigned int> > *listPositions = new QVector<QVector<unsigned int> >;
00541
00542     QVector<unsigned int> modifiedPosition(lastAdd);
00543
00544     // "x_d - 1" tree
00545     if (modifiedPosition.at(dimension-1) != 0) // Avoid "negative" position
00546         modifiedPosition.replace(dimension-1, position.at(dimension-1) - 1);
00547     listPositions->append(*getListNeighboursPositionsRecursive(position,
       dimension -1, modifiedPosition));
00548     if (!listPositions->count(modifiedPosition))
00549         listPositions->push_back(modifiedPosition);
00550
00551     // "x_d" tree
00552     modifiedPosition.replace(dimension-1, position.at(dimension-1));
00553     listPositions->append(*getListNeighboursPositionsRecursive(position,
       dimension -1, modifiedPosition));
00554     if (!listPositions->count(modifiedPosition))
00555         listPositions->push_back(modifiedPosition);
00556
00557     // "x_d + 1" tree
00558     if (modifiedPosition.at(dimension -1) + 1 < m_dimensions.at(dimension-1)) // Avoid position
       out of the cell space
00559         modifiedPosition.replace(dimension-1, position.at(dimension-1) +1);
00560     listPositions->append(*getListNeighboursPositionsRecursive(position,
       dimension -1, modifiedPosition));
00561     if (!listPositions->count(modifiedPosition))
00562         listPositions->push_back(modifiedPosition);
00563
00564     return listPositions;
00565
00566 }
00567
00572 template<typename CellHandler_T, typename Cell_T>
00573 CellHandler::iteratorT<CellHandler_T,Cell_T>::iteratorT
      (CellHandler_T *handler):
00574         m_handler(handler), m_changedDimension(0)
00575 {
00576     // Initialisation of m_position
00577     for (unsigned short i = 0; i < handler->m_dimensions.size(); i++)
00578     {
00579         m_position.push_back(0);
00580     }
00581     m_zero = m_position;
00582 }
```

8.15 cellhandler.h File Reference

```
#include <QString>
#include <QFile>
#include <QJsonDocument>
#include <QtWidgets>
#include <QMap>
#include <QRegExpValidator>
```

```
#include <QDebug>
#include "cell.h"
```

Classes

- class CellHandler

  Cell container and cell generator.
- class CellHandler::iteratorT< CellHandler_T, Cell_T >

  Implementation of iterator design pattern with a template to generate iterator and const_iterator at the same time.

8.16 cellhandler.h

```
00001 #ifndef CELLHANDLER_H
00002 #define CELLHANDLER_H
00003
00004 #include <QString>
00005 #include <QFile>
00006 #include <QJsonDocument>
00007 #include <QtWidgets>
00008 #include <QMap>
00009 #include <QRegExpValidator>
00010 #include <QDebug>
00011
00012 #include "cell.h"
00013
00014
00015
00020 class CellHandler
00021 {
00022
00040     template <typename CellHandler_T, typename Cell_T>
00041     class iteratorT
00042     {
00043         friend class CellHandler;
00044     public:
00045         iteratorT(CellHandler_T* handler);
00047         iteratorT& operator++(){
00048             m_position.replace(0, m_position.at(0) + 1); // adding the value to the
      first digit
00049
00050             m_changedDimension = 0;
00051             // Carry management
00052             for (unsigned short i = 0; i < m_handler->m_dimensions.size(); i++)
00053             {
00054                 if (m_position.at(i) >= m_handler->m_dimensions.at(i))
00055                 {
00056                     m_position.replace(i, 0);
00057                     m_changedDimension++;
00058                     if (i + 1 != m_handler->m_dimensions.size())
00059                         m_position.replace(i+1, m_position.at(i+1)+1);
00060                 }
00061
00062             }
00063             // If we return to zero, we have finished
00064             if (m_position == m_zero)
00065                 m_finished = true;
00066
00067             return *this;
00068
00069         }
00071         Cell_T* operator->() const{
00072             return m_handler->m_cells.value(m_position);
00073         }
00075         Cell_T* operator*() const{
00076             return m_handler->m_cells.value(m_position);
00077         }
00078
00079         bool operator!=(bool finished) const { return (m_finished != finished); }
00080         unsigned int changedDimension() const{
00081             return m_changedDimension;
00082         }
00083
00084
```

```
00085
00086     private:
00087         CellHandler_T *m_handler;
00088         QVector<unsigned int> m_position;
00089         bool m_finished = false;
00090         QVector<unsigned int> m_zero;
00091         unsigned int m_changedDimension;
00092     };
00093 public:
00094     typedef iteratorT<const CellHandler, const Cell>
      const_iterator;
00095     typedef iteratorT<CellHandler, Cell> iterator;
00096
00099     enum generationTypes {
00100         empty,
00101         random,
00102         symetric
00103     };
00104
00105     CellHandler(const QString filename);
00106     CellHandler(const QJsonObject &json);
00107     CellHandler(const QVector<unsigned int> dimensions,
      generationTypes type = empty, unsigned int stateMax = 1, unsigned int density = 20);
00108     virtual ~CellHandler();
00109
00110     Cell* getCell(const QVector<unsigned int> position) const;
00111     static unsigned int getMaxState();
00112     QVector<unsigned int> getDimensions() const;
00113     void nextStates() const;
00114     bool previousStates() const;
00115     void reset() const;
00116
00117     bool save(QString filename) const;
00118
00119     void generate(generationTypes type, unsigned int stateMax = 1, unsigned short
      density = 50);
00120     void print(std::ostream &stream) const;
00121
00122     const_iterator begin() const;
00123     iterator begin();
00124     bool end() const;
00125
00126
00127 private:
00128     bool load(const QJsonObject &json);
00129     void foundNeighbours();
00130     void positionIncrement(QVector<unsigned int> &pos, unsigned int value = 1) const;
00131     QVector<QVector<unsigned int> > *getListNeighboursPositionsRecursive
      (const QVector<unsigned int> position, unsigned int dimension, QVector<unsigned int> lastAdd) const;
00132     QVector<QVector<unsigned int> > &getListNeighboursPositions(const
      QVector<unsigned int> position) const;
00133
00134     QVector<unsigned int> m_dimensions;
00135     QMap<QVector<unsigned int>, Cell* > m_cells;
00136 };
00137
00138 template class CellHandler::iteratorT<CellHandler, Cell>;
00139 template class CellHandler::iteratorT<const CellHandler, const Cell>
      ;
00140
00141 #endif // CELLHANDLER_H
```

8.17 creationdialog.cpp File Reference

```
#include "creationdialog.h"
#include <iostream>
```

8.18 creationdialog.cpp

```
00001 #include "creationdialog.h"
00002 #include <iostream>
00003
00006 CreationDialog::CreationDialog(QWidget *parent) : QDialog(parent)
00007 {
```

```
00008     QLabel *m_dimLabel= new QLabel(tr("Write your dimensions and their size, separated by a comma.\n"
00009                           "For instance, '25,25 ' will create a 2-dimensional 25x25 Automaton. "));
00010     QLabel *m_densityLabel = new QLabel(tr("Density :"));
00011     QLabel *m_stateMaxLabel = new QLabel(tr("Max state :"));
00012     m_densityBox = new QSpinBox();
00013     m_densityBox->setValue(20);
00014     m_stateMaxBox = new QSpinBox();
00015     m_stateMaxBox->setValue(1);
00016 
00017     QHBoxLayout *densityLayout = new QHBoxLayout();
00018     densityLayout->addWidget(m_densityLabel);
00019     densityLayout->addWidget(m_densityBox);
00020 
00021     QHBoxLayout *stateMaxLayout = new QHBoxLayout();
00022     stateMaxLayout->addWidget(m_stateMaxLabel);
00023     stateMaxLayout->addWidget(m_stateMaxBox);
00024 
00025     m_dimensionsEdit = new QLineEdit;
00026     QRegExp rgx("([0-9]+,)*");
00027     QRegExpValidator *v = new QRegExpValidator(rgx, this);
00028     m_dimensionsEdit->setValidator(v);
00029     m_doneBt = new QPushButton(tr("Done !"));
00030 
00031     QVBoxLayout *layout = new QVBoxLayout;
00032 
00033     QGroupBox *grpBox = createGenButtons();
00034 
00035     layout->addWidget(m_dimLabel);
00036     layout->addWidget(m_dimensionsEdit);
00037     layout->addLayout(densityLayout);
00038     layout->addLayout(stateMaxLayout);
00039     layout->addWidget(grpBox);
00040     layout->addWidget(m_doneBt);
00041     setLayout(layout);
00042 
00043     connect(m_doneBt, SIGNAL(clicked(bool)), this, SLOT(processSettings()));
00044 
00045 }
00046 
00052 QGroupBox *CreationDialog::createGenButtons(){
00053     m_groupBox = new QGroupBox(tr("Cell generation settings"));
00054     m_empGen = new QRadioButton(tr("&Empty Board"));
00055     m_randGen = new QRadioButton(tr("&Random"));
00056     m_symGen = new QRadioButton(tr("&Symmetrical"));
00057 
00058     QVBoxLayout *layout = new QVBoxLayout;
00059     layout->addWidget(m_empGen);
00060     layout->addWidget(m_randGen);
00061     layout->addWidget(m_symGen);
00062 
00063     m_groupBox->setLayout(layout);
00064 
00065     return m_groupBox;
00066 }
00067 
00073 void CreationDialog::processSettings(){
00074     QString dimensions = m_dimensionsEdit->text();
00075     if(dimensions.length() == 0){
00076         QMessageBox messageBox;
00077         messageBox.critical(0,"Error","You must specify valid dimensions !");
00078         messageBox.setFixedSize(500,200);
00079     }
00080     else{
00081         CellHandler::generationTypes genType;
00082         if(m_symGen->isChecked()) genType = CellHandler::generationTypes::symetric;
00083         else if(m_randGen->isChecked()) genType = CellHandler::generationTypes::random;
00084         else genType = CellHandler::generationTypes::empty;
00085         QStringList dimList = m_dimensionsEdit->text().split(",");
00086         QVector<unsigned int> dimensions;
00087         for(int i = 0; i < dimList.size(); i++) dimensions.append(dimList.at(i).toInt());
00088 
00089         emit settingsFilled(dimensions, genType, m_stateMaxBox->value(),
      m_densityBox->value());
00090         this->close();
00091     }
00092 
00093 }
00094 
```

8.19 creationdialog.h File Reference

```
#include <QtWidgets>
```

```
#include "cellhandler.h"
```

Classes

- class CreationDialog

  Automaton creation dialog box.

8.20 creationdialog.h

```
00001 #ifndef CREATIONDIALOG_H
00002 #define CREATIONDIALOG_H
00003
00004 #include <QtWidgets>
00005 #include "cellhandler.h"
00006
00013 class CreationDialog : public QDialog
00014 {
00015     Q_OBJECT
00016
00017 public:
00018     CreationDialog(QWidget *parent = 0);
00019
00020 signals:
00021     void settingsFilled(const QVector<unsigned int> dimensions,
00022                         CellHandler::generationTypes type =
      CellHandler::generationTypes::empty,
00023                         unsigned int stateMax = 1, unsigned int density = 20);
00024
00025 public slots:
00026     void processSettings();
00027
00028 private:
00029     QLineEdit *m_dimensionsEdit;
00030     QSpinBox *m_densityBox;
00031     QSpinBox *m_stateMaxBox;
00032     QPushButton *m_doneBt;
00033
00034     QGroupBox *m_groupBox;
00035     QRadioButton *m_empGen;
00036     QRadioButton *m_randGen;
00037     QRadioButton *m_symGen;
00038
00039     QGroupBox *createGenButtons();
00040
00041
00042
00043
00044
00045
00046 };
00047
00048 #endif // CREATEDIALOG_H
```

8.21 main.cpp File Reference

```
#include <QApplication>
#include <QDebug>
#include "cell.h"
#include "mainwindow.h"
#include "ruleeditor.h"
```

Functions

- int main (int argc, char *argv[])

8.21.1 Function Documentation

8.21.1.1 main()

```
int main (
            int argc,
            char * argv[] )
```

Definition at line 7 of file main.cpp.

8.22 main.cpp

```
00001 #include <QApplication>
00002 #include <QDebug>
00003 #include "cell.h"
00004 #include "mainwindow.h"
00005 #include "ruleeditor.h"
00006
00007 int main(int argc, char * argv[])
00008 {
00009     QApplication app(argc, argv);
00010     QApplication::setAttribute(Qt::AA_UseHighDpiPixmaps);
00011
00012     app.setOrganizationName("LO21-project");
00013     app.setApplicationName("AutoCell");
00014
00015     MainWindow w;
00016     w.show();
00017
00018     return app.exec();
00019
00020 }
```

8.23 mainwindow.cpp File Reference

```
#include "mainwindow.h"
#include <iostream>
#include "math.h"
```

8.24 mainwindow.cpp

```
00001 #include "mainwindow.h"
00002 #include <iostream>
00003 #include "math.h"
00004
00007 MainWindow::MainWindow(QWidget *parent) : QMainWindow(parent)
00008 {
00009     createButtons();
00010     createToolBar();
00011
00012
00013     setMinimumSize(500,500);
00014     setWindowTitle("AutoCell");
00015
00016     m_tabs = NULL;
00017     m_running = false;
00018
```

```
00019     QSettings settings;
00020     int nbAutomate = settings.value("nbAutomate").toInt();
00021     for (int i = 0; i < nbAutomate; i++)
00022     {
00023         QString fileName = QString(".automate"+QString::number(i));
00024         try{
00025             AutomateHandler::getAutomateHandler().
      addAutomate(new Automate(QString(fileName+".atc"), QString(fileName+".atr")));
00026         if(m_tabs == NULL)
00027             createTabs();
00028         m_tabs->addTab(createTab(), "Automaton "+ QString::number(
      AutomateHandler::getAutomateHandler().getNumberAutomates()));
00029         updateBoard(AutomateHandler::getAutomateHandler().
      getNumberAutomates()-1);
00030         }
00031         catch (QString &s)
00032         {
00033             QMessageBox msgBox;
00034             msgBox.warning(0,"Error",s);
00035             msgBox.setFixedSize(500,200);
00036         }
00037         QFile fichier(QString(fileName + ".atc"));
00038         fichier.remove();
00039         fichier.close();
00040         QFile fichier2(QString(fileName + ".atr"));
00041         fichier2.remove();
00042     }
00043     m_zoom->setValue(settings.value("zoom").toInt());
00044     m_timeStep->setValue(settings.value("timestamp").toInt());
00045 }
00046
00051 MainWindow::~MainWindow()
00052 {
00053     // Saving settings for further sessions
00054     QSettings settings;
00055     settings.setValue("nbAutomate", AutomateHandler::getAutomateHandler(
      ).getNumberAutomates());
00056     settings.setValue("zoom", m_zoom->value());
00057     settings.setValue("timestamp", m_timeStep->value());
00058
00059     for (unsigned int i = 0; i < AutomateHandler::getAutomateHandler().
      getNumberAutomates(); i++)
00060     {
00061         AutomateHandler::getAutomateHandler().
      getAutomate(i)->saveAll(QString(".automate"+QString::number(i)+".atc"), QString("
      .automate"+QString::number(i)+".atr"));
00062     }
00063
00064 }
00065
00066
00071 void MainWindow::createButtons(){
00072
00073     QPixmap previousStatePm(":/icons/icons/fast-backward.svg");
00074     QPixmap previousStateHoveredPm(":/icons/icons/fast-backward-full.svg");
00075     QPixmap nextStatePm(":/icons/icons/fast-forward.svg");
00076     QPixmap nextStateHoveredPm(":/icons/icons/fast-forward-full.svg");
00077     QPixmap playPm(":/icons/icons/play.svg");
00078     QPixmap playHoveredPm(":/icons/icons/play-full.svg");
00079     QPixmap newPm(":/icons/icons/new.svg");
00080     QPixmap openPm(":/icons/icons/open.svg");
00081     QPixmap savePm(":/icons/icons/save.svg");
00082     QPixmap pausePm(":/icons/icons/pause.svg");
00083     QPixmap resetPm(":/icons/icons/reset.svg");
00084
00085     QIcon previousStateIcon;
00086     QIcon nextStateIcon;
00087     QIcon newIcon;
00088     QIcon saveIcon;
00089     QIcon openIcon;
00090     QIcon resetIcon;
00091
00092     previousStateIcon.addPixmap(previousStatePm, QIcon::Normal, QIcon::Off);
00093     previousStateIcon.addPixmap(previousStateHoveredPm, QIcon::Active, QIcon::Off);
00094     nextStateIcon.addPixmap(nextStatePm, QIcon::Normal, QIcon::Off);
00095     nextStateIcon.addPixmap(nextStateHoveredPm, QIcon::Active, QIcon::Off);
00096     m_playIcon.addPixmap(playPm, QIcon::Normal, QIcon::Off);
00097     m_playIcon.addPixmap(playHoveredPm, QIcon::Active, QIcon::Off);
00098     m_pauseIcon.addPixmap(pausePm, QIcon::Normal, QIcon::Off);
00099     newIcon.addPixmap(newPm, QIcon::Normal, QIcon::Off);
00100     saveIcon.addPixmap(savePm, QIcon::Normal, QIcon::Off);
00101     openIcon.addPixmap(openPm, QIcon::Normal, QIcon::Off);
00102     resetIcon.addPixmap(resetPm, QIcon::Normal, QIcon::Off);
00103
00104     QAction *playPause = new QAction(m_playIcon, tr("Play"), this);
00105     QAction *nextState = new QAction(nextStateIcon, tr("&Next state"), this);
00106     QAction *previousState = new QAction(previousStateIcon, tr("&Previous state"), this);
```

```
00107     QAction *openAutomaton = new QAction(openIcon, tr("Open automaton"), this);
00108     QAction *saveAutomaton = new QAction(saveIcon, tr("Save automaton"), this);
00109     QAction *newAutomaton = new QAction(newIcon, tr("New automaton"), this);
00110     QAction *resetAutomaton = new QAction(resetIcon, tr("Reset automaton"), this);
00111 
00112     m_previousStateBt = new QToolButton(this);
00113     m_nextStateBt = new QToolButton(this);
00114     m_playPauseBt = new QToolButton(this);
00115     m_saveAutomatonBt = new QToolButton(this);
00116     m_newAutomatonBt = new QToolButton(this);
00117     m_openAutomatonBt = new QToolButton(this);
00118     m_resetBt = new QToolButton(this);
00119 
00120     m_previousStateBt->setDefaultAction(previousState);
00121     m_nextStateBt->setDefaultAction(nextState);
00122     m_playPauseBt->setDefaultAction(playPause);
00123     m_saveAutomatonBt->setDefaultAction(saveAutomaton);
00124     m_newAutomatonBt->setDefaultAction(newAutomaton);
00125     m_openAutomatonBt->setDefaultAction(openAutomaton);
00126     m_resetBt->setDefaultAction(resetAutomaton);
00127 
00128     m_previousStateBt->setIconSize(QSize(30,30));
00129     m_nextStateBt->setIconSize(QSize(30,30));
00130     m_playPauseBt->setIconSize(QSize(30,30));
00131     m_saveAutomatonBt->setIconSize(QSize(30,30));
00132     m_newAutomatonBt->setIconSize(QSize(30,30));
00133     m_openAutomatonBt->setIconSize(QSize(30,30));
00134     m_resetBt->setIconSize(QSize(30,30));
00135 
00136 
00137     m_zoom = new QSlider(Qt::Horizontal);
00138     m_zoom->setValue(m_cellSize);
00139     m_zoom->setMinimum(4);
00140     m_zoom->setMaximum(100);
00141     m_zoom->setFixedWidth(100);
00142 
00143 
00144     connect(m_openAutomatonBt, SIGNAL(clicked(bool)), this, SLOT(
      openFile()));
00145     connect(m_newAutomatonBt, SIGNAL(clicked(bool)), this, SLOT(
      openCreationWindow()));
00146     connect(m_saveAutomatonBt, SIGNAL(clicked(bool)), this, SLOT(
      saveToFile()));
00147     connect(m_nextStateBt, SIGNAL(clicked(bool)), this, SLOT(
      forward()));
00148     connect(m_previousStateBt, SIGNAL(clicked(bool)), this, SLOT(
      backward()));
00149     connect(m_playPauseBt, SIGNAL(clicked(bool)), this, SLOT(
      handlePlayPause()));
00150     connect(m_resetBt,SIGNAL(clicked(bool)), this,SLOT(reset()));
00151     connect(m_zoom, SIGNAL(valueChanged(int)), this, SLOT(setSize(int)));
00152 
00153 }
00154 
00159 void MainWindow::createToolBar(){
00160     m_toolBar = new QToolBar(this);
00161     QLabel *timeStepLabel = new QLabel(tr("Timestep(ms)"),this);
00162     m_timeStep = new QSpinBox(this);
00163     m_timeStep->setMaximum(10000);
00164     m_timeStep->setValue(500);
00165     timeStepLabel->setFixedWidth(90);
00166     m_timeStep->setFixedWidth(60);
00167     m_toolBar->setMovable(false);
00168 
00169     QLabel *cellSetterLabel = new QLabel(tr("Cell value"));
00170     m_cellSetter = new QSpinBox(this);
00171     connect(m_cellSetter, SIGNAL(valueChanged(int)),this, SLOT(
      changeCellValue()));
00172     QLabel *zoomLabel = new QLabel(tr("Zoom"),this);
00173     QVBoxLayout* zoomLayout = new QVBoxLayout();
00174     zoomLayout->addWidget(zoomLabel, Qt::AlignCenter);
00175     zoomLayout->addWidget(m_zoom, Qt::AlignCenter);
00176 
00177     QVBoxLayout* tsLayout = new QVBoxLayout();
00178     tsLayout->addWidget(timeStepLabel, Qt::AlignCenter);
00179     tsLayout->addWidget(m_timeStep, Qt::AlignCenter);
00180 
00181     QVBoxLayout* csLayout = new QVBoxLayout();
00182     csLayout->addWidget(cellSetterLabel, Qt::AlignCenter);
00183     csLayout->addWidget(m_cellSetter, Qt::AlignCenter);
00184 
00185     QHBoxLayout *tbLayout = new QHBoxLayout(this);
00186     tbLayout->addLayout(zoomLayout);
00187     tbLayout->addWidget(m_newAutomatonBt, Qt::AlignCenter);
00188     tbLayout->addWidget(m_openAutomatonBt, Qt::AlignCenter);
00189     tbLayout->addWidget(m_saveAutomatonBt, Qt::AlignCenter);
00190     tbLayout->addWidget(m_previousStateBt, Qt::AlignCenter);
```

```
00191     tbLayout->addWidget(m_playPauseBt, Qt::AlignCenter);
00192     tbLayout->addWidget(m_nextStateBt, Qt::AlignCenter);
00193     tbLayout->addWidget(m_resetBt, Qt::AlignCenter);
00194     tbLayout->addLayout(tsLayout);
00195     tbLayout->addLayout(csLayout);
00196
00197
00198
00199     tbLayout->setAlignment(Qt::AlignCenter);
00200     QWidget* wrapper = new QWidget(this);
00201     wrapper->setLayout(tbLayout);
00202     m_toolBar->addWidget(wrapper);
00203     addToolBar(m_toolBar);
00204
00205
00206 }
00207
00212 QWidget* MainWindow::createTab(){
00213     QWidget *tab = new QWidget(this);
00214     QVBoxLayout *layout = new QVBoxLayout(this);
00215     QVector<unsigned int> dimensions = AutomateHandler::getAutomateHandler
      ().getAutomate(AutomateHandler::getAutomateHandler().
      getNumberAutomates()-1)->getCellHandler().getDimensions();
00216     int boardVSize = 0;
00217     int boardHSize = 0;
00218     if(dimensions.size() > 1){
00219         boardVSize = dimensions[0];
00220         boardHSize = dimensions[1];
00221     }
00222     else{
00223         boardVSize = 1;
00224         boardHSize = dimensions[0];
00225     }
00226
00227     QTableWidget* board = new QTableWidget(boardVSize, boardHSize, this);
00228         board->setFixedSize(boardHSize*m_cellSize,boardVSize*
      m_cellSize);
00229         //setMinimumSize(m_boardHSize*m_cellSize,100+m_boardVSize*m_cellSize);
00230         board->horizontalHeader()->setVisible(false);
00231         board->verticalHeader()->setVisible(false);
00232         board->setVerticalScrollBarPolicy(Qt::ScrollBarAlwaysOff);
00233         board->setHorizontalScrollBarPolicy(Qt::ScrollBarAlwaysOff);
00234         board->setEditTriggers(QAbstractItemView::NoEditTriggers);
00235         for(int col = 0; col < boardHSize; ++col)
00236             board->setColumnWidth(col, m_cellSize);
00237         for(int row = 0; row < boardVSize; ++row) {
00238             board->setRowHeight(row, m_cellSize);
00239             for(int col = 0; col < boardHSize; ++col) {
00240                 board->setItem(row, col, new QTableWidgetItem(""));
00241                 board->item(row, col)->setBackgroundColor("white");
00242                 board->item(row, col)->setTextColor("black");
00243             }
00244         }
00245      QScrollArea *scrollArea = new QScrollArea(this);
00246      scrollArea->setWidget(board);
00247
00248      layout->setContentsMargins(0,0,0,0);
00249      layout->addWidget(scrollArea);
00250      tab->setLayout(layout);
00251      connect(board, SIGNAL(cellClicked(int,int)), this, SLOT(cellPressed(int,int)));
00252      return tab;
00253 }
00254
00258 void MainWindow::openFile(){
00259     QString fileName = QFileDialog::getOpenFileName(this, tr("Open Cell file"), ".",
00260                                                     tr("Automaton cell files (*.atc)"));
00261     if(!fileName.isEmpty()){
00262         AutomateHandler::getAutomateHandler().
      addAutomate(new Automate(fileName));
00263         if(m_tabs == NULL) createTabs();
00264         m_tabs->addTab(createTab(), "Automaton "+ QString::number(
      AutomateHandler::getAutomateHandler().getNumberAutomates()+1));
00265         updateBoard(AutomateHandler::getAutomateHandler().
      getNumberAutomates()-1);
00266
00267         RuleEditor* ruleEditor = new RuleEditor(
      AutomateHandler::getAutomateHandler().getAutomate(
      AutomateHandler::getAutomateHandler().getNumberAutomates()-1)->
      getCellHandler().getDimensions().size(), this);
00268         connect(ruleEditor, SIGNAL(fileImported(QString)),this,SLOT(
      addAutomatonRuleFile(QString)));
00269         connect(ruleEditor, SIGNAL(rulesFilled(QList<const NeighbourRule*>)), this, SLOT(
      addAutomatonRules(QList<const NeighbourRule*>)));
00270         ruleEditor->show();
00271     }
00272 }
00273
```

```
00274
00278 void MainWindow::saveToFile(){
00279     if(AutomateHandler::getAutomateHandler().getNumberAutomates() > 0){
00280         QString automatonFileName = QFileDialog::getSaveFileName(this, tr("Save Automaton cell
      configuration"),
00281                                                                   ".", tr("Automaton Cells file (*.atc"));
00282         AutomateHandler::getAutomateHandler().
      getAutomate(m_tabs->currentIndex())->saveCells(automatonFileName+".atc");
00283         QString ruleFileName = QFileDialog::getSaveFileName(this, tr("Save Automaton rules"),
00284                                                                   ".", tr("Automaton Rules file (*.atr"));
00285         AutomateHandler::getAutomateHandler().
      getAutomate(m_tabs->currentIndex())->saveRules(ruleFileName+".atr");
00286     }
00287     else{
00288         QMessageBox msgBox;
00289         msgBox.critical(0,"Error","Please create or import an Automaton first !");
00290         msgBox.setFixedSize(500,200);
00291     }
00292 }
00293
00298 void MainWindow::openCreationWindow(){
00299     CreationDialog *window = new CreationDialog(this);
00300     connect(window, SIGNAL(settingsFilled(QVector<uint>,
      CellHandler::generationTypes,uint,uint)),
00301             this, SLOT(receiveCellHandler(QVector<uint>,
      CellHandler::generationTypes,uint,uint)));
00302     window->show();
00303 }
00304
00311 void MainWindow::receiveCellHandler(const QVector<unsigned int> dimensions,
00312                                     CellHandler::generationTypes type,
00313                                     unsigned int stateMax, unsigned int density){
00314     AutomateHandler::getAutomateHandler().
      addAutomate(new Automate(dimensions, type, stateMax, density));
00315
00316     if(m_tabs == NULL) createTabs();
00317     QWidget* newTab = createTab();
00318     m_tabs->addTab(newTab, "Automaton "+ QString::number(
      AutomateHandler::getAutomateHandler().getNumberAutomates()));
00319     m_tabs->setCurrentWidget(newTab);
00320     updateBoard(AutomateHandler::getAutomateHandler().
      getNumberAutomates()-1);
00321
00322     RuleEditor* ruleEditor = new RuleEditor(
      AutomateHandler::getAutomateHandler().getAutomate(
      AutomateHandler::getAutomateHandler().getNumberAutomates()-1)->
      getCellHandler().getDimensions().size(), this);
00323     connect(ruleEditor, SIGNAL(fileImported(QString)),this,SLOT(
      addAutomatonRuleFile(QString)));
00324     connect(ruleEditor, SIGNAL(rulesFilled(QList<const Rule*>)), this, SLOT(
      addAutomatonRules(QList<const Rule*>)));
00325     ruleEditor->show();
00326
00327 }
00328
00333 void MainWindow::nextState(unsigned int n){
00334     if(AutomateHandler::getAutomateHandler().getNumberAutomates()== 0){
00335         QMessageBox msgBox;
00336         msgBox.critical(0,"Error","Please create or import an Automaton first !");
00337         msgBox.setFixedSize(500,200);
00338     }
00339     else{
00340
00341         AutomateHandler::getAutomateHandler().
      getAutomate(m_tabs->currentIndex())->run(n);
00342         updateBoard(m_tabs->currentIndex());
00343     }
00344 }
00345
00350 void MainWindow::updateBoard(int index){
00351     if(AutomateHandler::getAutomateHandler().getNumberAutomates()== 0){
00352         QMessageBox msgBox;
00353         msgBox.critical(0,"Error","Please create or import an Automaton first !");
00354         msgBox.setFixedSize(500,200);
00355     }
00356     else{
00357
00358         const CellHandler* cellHandler = &(
      AutomateHandler::getAutomateHandler().
      getAutomate(index)->getCellHandler());
00359         QVector<unsigned int> dimensions = cellHandler->getDimensions();
00360         QTableWidget* board = getBoard(index);
00361         if(dimensions.size() > 1){
00362             int i = 0;
00363             int j = 0;
00364             for (CellHandler::const_iterator it = cellHandler->
      begin(); it != cellHandler->end() && it.changedDimension() < 2; ++it){
```

```
00365                     if(it.changedDimension() > 0){
00366                         i = 0;
00367                         j++;
00368                     }
00369                     board->item(i,j)->setBackgroundColor(getColor(it->getState()));
00370                     i++;
00371             }
00372         }
00373         else{ // dimension = 1
00374             if (board->rowCount() != 1)
00375                 addEmptyRow(index);
00376             int i = board->rowCount() -1;
00377             int j = 0;
00378             for (CellHandler::const_iterator it = cellHandler->
      begin(); it != cellHandler->end() && it.changedDimension() < 1; ++it){
00379                     board->item(i,j)->setBackgroundColor(getColor(it->getState()));
00380                     j++;
00381             }
00382             if (board->rowCount() == 1)
00383                 addEmptyRow(index);
00384 
00385             // Go to bottom
00386             QScrollArea *scrool = static_cast<QScrollArea*>(m_tabs->currentWidget()->layout()->itemAt
     (0)->widget());
00387 
00388             scrool->verticalScrollBar()->setSliderPosition(scrool->verticalScrollBar()->maximum());
00389 
00390         }
00391 
00392     }
00393 
00394 }
00395 
00400 void MainWindow::forward(){
00401     nextState(1);
00402 }
00403 
00407 QTableWidget* MainWindow::getBoard(int n){
00408     return m_tabs->widget(n)->findChild<QTableWidget *>();
00409 }
00410 
00413 QColor MainWindow::getColor(int cellState)
00414 {
00415     if (cellState > QColor::colorNames().size() -2)
00416         return Qt::black;
00417     switch (cellState)
00418     {
00419     case 0:
00420         return Qt::white;
00421     case 1:
00422         return Qt::black;
00423     case 2:
00424         return Qt::red;
00425     case 3:
00426         return Qt::green;
00427     case 4:
00428         return Qt::blue;
00429     case 5:
00430         return Qt::yellow;
00431     case 6:
00432         return QColor(170, 110, 40); // brown
00433     case 7:
00434         return QColor(145,30, 180); // purple
00435     case 8:
00436         return QColor(245,130,48); // orange
00437     case 9:
00438         return Qt::cyan;
00439     case 10:
00440         return Qt::magenta;
00441     case 11:
00442         return QColor(210, 245, 60); // Lime
00443     case 12:
00444         return QColor(250, 190, 190); // pink
00445     case 13:
00446         return QColor(0,128,128); // Teal
00447     case 14:
00448         return QColor(230, 190, 255); // Lavender
00449     case 15:
00450         return QColor(255, 250, 200); // beige
00451     case 16:
00452         return QColor(128, 0,0); // Maroon
00453     case 17:
00454         return QColor(170, 255, 195); // Mint
00455     case 18:
00456         return QColor(128, 128, 0); // Olive
00457     case 19:
00458         return QColor(255, 215, 180); // Coral
```

```
00459     case 20:
00460         return QColor(0,0,128); // Navy
00461     case 21:
00462         return Qt::gray;
00463 
00464 
00465     }
00466 
00467     return QColor((Qt::GlobalColor)(cellState +2));
00468 }
00469 
00474 void MainWindow::createTabs(){
00475     m_tabs = new QTabWidget(this);
00476     m_tabs->setMovable(true);
00477     m_tabs->setTabsClosable(true);
00478     setCentralWidget(m_tabs);
00479     connect(m_tabs, SIGNAL(tabCloseRequested(int)), this, SLOT(closeTab(int)));
00480     connect(m_tabs, SIGNAL(currentChanged(int)), this, SLOT(
      handleTabChanged()));
00481 }
00482 
00489 void MainWindow::addEmptyRow(unsigned int n)
00490 {
00491     QTableWidget *board = getBoard(n);
00492     board->setFixedHeight(board->height() + m_cellSize);
00493     unsigned int row = board->rowCount();
00494     board->insertRow(row);
00495     board->setRowHeight(row, m_cellSize);
00496     for(int col = 0; col < board->columnCount(); ++col) {
00497         board->setItem(row, col, new QTableWidgetItem(""));
00498         board->item(row, col)->setBackgroundColor("white");
00499         board->item(row, col)->setTextColor("black");
00500     }
00501 }
00502 
00507 void MainWindow::closeTab(int n){
00508     m_tabs->setCurrentIndex(n);
00509     saveToFile();
00510     AutomateHandler::getAutomateHandler().
      deleteAutomate(AutomateHandler::getAutomateHandler().
      getAutomate(n));
00511     m_tabs->removeTab(n);
00512 }
00513 
00518 void MainWindow::addAutomatonRules(QList<const Rule *> rules){
00519     for(int i =0 ; i < rules.size();i++)
00520     {
00521         AutomateHandler::getAutomateHandler().
      getAutomate(AutomateHandler::getAutomateHandler().
      getNumberAutomates()-1)->addRule(rules.at(i));
00522     }
00523 }
00524 
00529 void MainWindow::addAutomatonRuleFile(QString path){
00530     AutomateHandler::getAutomateHandler().
      getAutomate(AutomateHandler::getAutomateHandler().
      getNumberAutomates()-1)->addRuleFile(path);
00531 }
00532 
00537 void MainWindow::handlePlayPause(){
00538     if(AutomateHandler::getAutomateHandler().getNumberAutomates()== 0){
00539         QMessageBox msgBox;
00540         msgBox.critical(0,"Error","Please create or import an Automaton first !");
00541         msgBox.setFixedSize(500,200);
00542     }
00543     else{
00544         if(m_running){
00545             m_playPauseBt->setIcon(m_playIcon);
00546             delete m_timer;
00547         }
00548         else {
00549             m_playPauseBt->setIcon(m_pauseIcon);
00550             m_timer = new QTimer(this);
00551             connect(m_timer, SIGNAL(timeout()), this, SLOT(runAutomaton()));
00552             m_timer->start(m_timeStep->value());
00553         }
00554         m_running = !m_running;
00555     }
00556 
00557 
00558 }
00559 
00564 void MainWindow::runAutomaton(){
00565     if(m_running){
00566         AutomateHandler::getAutomateHandler().
      getAutomate(m_tabs->currentIndex())->run();
00567         QCoreApplication::processEvents();
```

```
00568         updateBoard(m_tabs->currentIndex());
00569         QCoreApplication::processEvents();
00570     }
00571 }
00572
00576 void MainWindow::reset(){
00577     if(AutomateHandler::getAutomateHandler().getNumberAutomates()== 0){
00578         QMessageBox msgBox;
00579         msgBox.critical(0,"Error","Please create or import an Automaton first !");
00580         msgBox.setFixedSize(500,200);
00581     }
00582     else{
00583         //QTableWidget *board = getBoard(m_tabs->currentIndex());
00584         //board->setRowCount(1);
00585         //board->setFixedHeight(m_cellSize);
00586
00587         AutomateHandler::getAutomateHandler().
      getAutomate(m_tabs->currentIndex())->getCellHandler().reset();
00588         if (AutomateHandler::getAutomateHandler().getAutomate(
      m_tabs->currentIndex())->getCellHandler().getDimensions().size() == 1)
00589         {
00590             QTableWidget *board  = getBoard(m_tabs->currentIndex());
00591             board->setRowCount(0);
00592             board->setFixedHeight(0);
00593         }
00594         updateBoard(m_tabs->currentIndex());
00595     }
00596 }
00597
00598
00603 void MainWindow::backward(){
00604     AutomateHandler::getAutomateHandler().
      getAutomate(m_tabs->currentIndex())->getCellHandler().previousStates();
00605     updateBoard(m_tabs->currentIndex());
00606 }
00607
00612 void MainWindow::cellPressed(int i, int j){
00613     QVector<unsigned int> coord;
00614
00615     m_currentCellX = i;
00616     m_currentCellY = j;
00617     const CellHandler* cellHandler = &(
      AutomateHandler::getAutomateHandler().
      getAutomate(m_tabs->currentIndex())->getCellHandler());
00618     if(cellHandler->getDimensions().size() > 1){
00619         coord.append(i);
00620         coord.append(j);
00621         m_cellSetter->setValue(cellHandler->getCell(coord)->
      getState());
00622     }
00623     else{
00624         coord.append(j);
00625         m_cellSetter->setValue(cellHandler->getCell(coord)->
      getState());
00626     }
00627 }
00628
00629
00634 void MainWindow::changeCellValue(){
00635     if(AutomateHandler::getAutomateHandler().getNumberAutomates()== 0){
00636         QMessageBox msgBox;
00637         msgBox.critical(0,"Error","Please create or import an Automaton first !");
00638         msgBox.setFixedSize(500,200);
00639     }
00640     else{
00641         if(m_currentCellX > -1 && m_currentCellY > -1){
00642             const CellHandler* cellHandler = &(
      AutomateHandler::getAutomateHandler().
      getAutomate(m_tabs->currentIndex())->getCellHandler());
00643             QVector<unsigned int> coord;
00644             if(cellHandler->getDimensions().size() > 1){
00645                 coord.append(m_currentCellX);
00646                 coord.append(m_currentCellY);
00647                 cellHandler->getCell(coord)->forceState(
      m_cellSetter->value());
00648                 updateBoard(m_tabs->currentIndex());
00649             }
00650             else{
00651                 coord.append(m_currentCellY);
00652                 cellHandler->getCell(coord)->forceState(
      m_cellSetter->value());
00653                 QTableWidget *board = getBoard(m_tabs->currentIndex());
00654                 int i = 0;
00655                 int j = 0;
00656                 for (CellHandler::const_iterator it = cellHandler->
      begin(); it != cellHandler->end() && it.changedDimension() < 1; ++it){
00657                     board->item(i,j)->setBackgroundColor(getColor(it->getState()));
```

```
00658                         j++;
00659                 }
00660             }
00661
00662         }
00663     }
00664 }
00665
00670 void MainWindow::handleTabChanged(){
00671     if(m_tabs->currentIndex() >= 0){
00672         m_cellSetter->setMaximum(CellHandler::getMaxState());
00673         m_currentCellX = -1;
00674         m_currentCellY = -1;
00675         if(m_running){
00676             m_playPauseBt->setIcon(m_playIcon);
00677             delete m_timer;
00678             m_running = !m_running;
00679         }
00680     }
00681
00682 }
00683
00687 void MainWindow::setSize(int newCellSize)
00688 {
00689     m_cellSize = newCellSize;
00690     if(AutomateHandler::getAutomateHandler().getNumberAutomates()!= 0)
00691     {
00692         for (int i = 0; i < m_tabs->count(); i++)
00693         {
00694             QTableWidget* board = getBoard(i);
00695             if (m_cellSize < 10)
00696                 board->setShowGrid(false);
00697             else
00698                 board->setShowGrid(true);
00699             for (int row = 0; row < board->rowCount(); row++)
00700                 board->setRowHeight(row, m_cellSize);
00701             for (int col = 0; col < board->columnCount(); col++)
00702                 board->setColumnWidth(col, m_cellSize);
00703             board->setFixedSize(board->columnCount()*m_cellSize, board->rowCount()*
      m_cellSize);
00704         }
00705     }
00706 }
```

8.25 mainwindow.h File Reference

```
#include <QMainWindow>
#include <QtWidgets>
#include "cellhandler.h"
#include "automate.h"
#include "creationdialog.h"
#include "automatehandler.h"
#include "ruleeditor.h"
```

Classes

- class MainWindow

  Simulation window.

8.26 mainwindow.h

```
00001 #ifndef MAINWINDOW_H
00002 #define MAINWINDOW_H
00003
00004 #include <QMainWindow>
00005 #include <QtWidgets>
```

```
00006 #include "cellhandler.h"
00007 #include "automate.h"
00008 #include "creationdialog.h"
00009 #include "automatehandler.h"
00010 #include "ruleeditor.h"
00011
00018 class MainWindow : public QMainWindow
00019 {
00020     Q_OBJECT
00021
00022     QTabWidget *m_tabs;
00023
00024     //Icons saved for reuse
00025     QIcon m_playIcon;
00026     QIcon m_pauseIcon;
00027
00028     //Buttons
00029     QToolButton *m_playPauseBt;
00030     QToolButton *m_nextStateBt;
00031     QToolButton *m_previousStateBt;
00032     QToolButton *m_openAutomatonBt;
00033     QToolButton *m_saveAutomatonBt;
00034     QToolButton *m_newAutomatonBt;
00035     QToolButton *m_resetBt;
00036
00037
00038     QSpinBox *m_timeStep;
00039     QSpinBox *m_cellSetter;
00040     QTimer* m_timer;
00041
00042     QSlider *m_zoom;
00043
00044     bool m_running;
00045     QToolBar *m_toolBar;
00046
00047     int m_currentCellX;
00048     int m_currentCellY;
00049
00050     // Board size settings
00051     unsigned int m_boardHSize = 25;
00052     unsigned int m_boardVSize = 25;
00053     unsigned int m_cellSize = 30;
00054
00055     void createButtons();
00056     void createToolBar();
00057     void createBoard();
00058     QWidget* createTab();
00059     void createTabs();
00060
00061     void addEmptyRow(unsigned int n);
00062     void updateBoard(int index);
00063     void nextState(unsigned int n);
00064     QTableWidget* getBoard(int n);
00065
00066     static QColor getColor(int cellState);
00067
00068
00069 public:
00070     explicit MainWindow(QWidget *parent = nullptr);
00071     virtual ~MainWindow();
00072
00073 signals:
00074
00075 public slots:
00076     void openFile();
00077     void saveToFile();
00078     void openCreationWindow();
00079     void receiveCellHandler(const QVector<unsigned int> dimensions,
00080                             CellHandler::generationTypes type =
      CellHandler::generationTypes::empty,
00081                             unsigned int stateMax = 1, unsigned int density = 20);
00082     void addAutomatonRules(QList<const Rule *> rules);
00083     void addAutomatonRuleFile(QString path);
00084     void forward();
00085     void backward();
00086     void closeTab(int n);
00087     void runAutomaton();
00088     void handlePlayPause();
00089     void reset();
00090     void cellPressed(int i, int j);
00091     void changeCellValue();
00092     void handleTabChanged();
00093     void setSize(int newCellSize);
00094
00095 };
00096
00097 #endif // MAINWINDOW_H
```

8.27 matrixrule.cpp File Reference

```
#include "matrixrule.h"
```

Functions

- QVector< unsigned int > fillInterval (unsigned int min, unsigned int max)

  Returns a vector fill of the integers between min and max (all included)

8.27.1 Function Documentation

8.27.1.1 fillInterval()

```
QVector<unsigned int> fillInterval (
            unsigned int min,
            unsigned int max )
```

Returns a vector fill of the integers between min and max (all included)

Returns

Interval

Parameters

min	Minimal value (included)
max	Maximal value (included)

Definition at line 8 of file matrixrule.cpp.

8.28 matrixrule.cpp

```
00001 #include "matrixrule.h"
00002
00008 QVector<unsigned int> fillInterval(unsigned int min, unsigned int max)
00009 {
00010     QVector<unsigned int> interval;
00011     for (unsigned int i = min; i <= max ; i++)
00012         interval.push_back(i);
00013
00014     return interval;
00015 }
00016
00021 MatrixRule::MatrixRule(unsigned int finalState, QVector<unsigned int> currentStates)
      :
00022     Rule(currentStates, finalState)
00023 {
00024 }
00025
```

```
00030 bool MatrixRule::matchCell(const Cell *cell) const
00031 {
00032     // Check cell state
00033     if (!m_currentCellPossibleValues.contains(cell->
      getState()))
00034     {
00035         return false;
00036     }
00037 
00038     // Check neighbours
00039     bool matched = true;
00040     // Rappel : QMap<relativePosition, possibleStates>
00041     for (QMap<QVector<short>,  QVector<unsigned int> >::const_iterator it =
      m_matrix.begin() ; it != m_matrix.end(); ++it)
00042     {
00043         if (cell->getNeighbour(it.key()) != nullptr) // Border management
00044         {
00045             if (! it.value().contains(cell->getNeighbour(it.key())->getState()))
00046             {
00047                 matched = false;
00048                 break;
00049             }
00050         }
00051         else
00052         {
00053             if (!it.value().contains(0))
00054             {
00055                 matched = false;
00056                 break;
00057             }
00058         }
00059 
00060     }
00061 
00062     return matched;
00063 }
00064 
00067 void MatrixRule::addNeighbourState(QVector<short> relativePosition, unsigned
      int matchState)
00068 {
00069     m_matrix[relativePosition].push_back(matchState);
00070 }
00071 
00074 void MatrixRule::addNeighbourState(QVector<short> relativePosition,
      QVector<unsigned int> matchStates)
00075 {
00076     for (QVector<unsigned int>::const_iterator it = matchStates.begin(); it != matchStates.end(); ++it)
00077         m_matrix[relativePosition].push_back(*it);
00078 }
00079 
00082 QJsonObject MatrixRule::toJson() const
00083 {
00084     QJsonObject object(Rule::toJson());
00085 
00086     object.insert("type", QJsonValue("matrix"));
00087 
00088     QJsonArray neighbours;
00089     for (QMap<QVector<short>,  QVector<unsigned int> >::const_iterator it =
      m_matrix.begin(); it != m_matrix.end(); ++it)
00090     {
00091         QJsonObject aNeighbour;
00092         QJsonArray relativePosition;
00093         for (unsigned int i = 0; i < it.key().size(); i++)
00094         {
00095             relativePosition.append(QJsonValue((int)it.key().at(i)));
00096         }
00097         aNeighbour.insert("relativePosition", relativePosition);
00098 
00099         QJsonArray neighbourStates;
00100         for (unsigned int i = 0; i < it.value().size(); i++)
00101         {
00102             neighbourStates.append(QJsonValue((int)it.value().at(i)));
00103         }
00104         aNeighbour.insert("neighbourStates", neighbourStates);
00105 
00106         neighbours.append(aNeighbour);
00107     }
00108     object.insert("neighbours", neighbours);
00109 
00110     return object;
00111 }
```

8.29 matrixrule.h File Reference

```
#include <QVector>
#include <QMap>
#include "cell.h"
#include "rule.h"
```

Classes

- class MatrixRule

  Manage specific rules, about specific values of specific neighbour.

Functions

- QVector< unsigned int > fillInterval (unsigned int min, unsigned int max)

  Returns a vector fill of the integers between min and max (all included)

8.29.1 Function Documentation

8.29.1.1 fillInterval()

```
QVector<unsigned int> fillInterval (
            unsigned int min,
            unsigned int max )
```

Returns a vector fill of the integers between min and max (all included)

Returns

Interval

Parameters

min	Minimal value (included)
max	Maximal value (included)

Definition at line 8 of file matrixrule.cpp.

8.30 matrixrule.h

```
00001 #ifndef MATRIXRULE_H
00002 #define MATRIXRULE_H
```

```
00003
00004 #include <QVector>
00005 #include <QMap>
00006 #include "cell.h"
00007 #include "rule.h"
00008
00009 QVector<unsigned int> fillInterval(unsigned int min, unsigned int max);
00010
00013 class MatrixRule : public Rule
00014 {
00015     public:
00016         MatrixRule(unsigned int finalState, QVector<unsigned int> currentStates =
      QVector<unsigned int>());
00017
00018
00019         virtual bool matchCell(const Cell* cell) const;
00020         virtual void addNeighbourState(QVector<short> relativePosition, unsigned int
      matchState);
00021         virtual void addNeighbourState(QVector<short> relativePosition, QVector<unsigned
       int> matchStates);
00022
00023         QJsonObject toJson() const;
00024
00025
00026 protected:
00027
00028         QMap<QVector<short>,  QVector<unsigned int> > m_matrix;
00029 };
00030
00031
00032
00033 #endif // MATRIXRULE_H
```

8.31 neighbourrule.cpp File Reference

```
#include "neighbourrule.h"
```

8.32 neighbourrule.cpp

```
00001 #include "neighbourrule.h"
00002
00084 bool NeighbourRule::inInterval(unsigned int matchingNeighbours)const
00085 {
00086     if(matchingNeighbours >= m_neighbourInterval.first && matchingNeighbours<=
      m_neighbourInterval.second)
00087         return true;
00088     else
00089         return false;
00090 }
00091
00095 NeighbourRule::NeighbourRule(unsigned int outputState, QVector<unsigned int>
      currentCellValues, QPair<unsigned int, unsigned int> intervalNbrNeighbour, QSet<unsigned int> neighbourValues)
       :
00096         Rule(currentCellValues, outputState), m_neighbourInterval(intervalNbrNeighbour),
      m_neighbourPossibleValues(neighbourValues)
00097 {
00098     if (m_neighbourInterval.second == 0)
00099         throw QString(QObject::tr("Low value of the number of neighbour interval can't be 0"));
00100     if (m_neighbourInterval.first > m_neighbourInterval.second)
00101         throw QString(QObject::tr("The interval must be (x,y) with x <= y"));
00102 }
00103
00104 NeighbourRule::~NeighbourRule()
00105 {
00106
00107 }
00108
00115 bool NeighbourRule::matchCell(const Cell *c)const
00116 {
00117     unsigned int matchingNeighbours = 0;
00118     if (!m_currentCellPossibleValues.contains(c->
      getState()))
00119         return false;
00120
```

```
00121    // QSet<unsigned int> set;
00122     //QSet<unsigned int> m_neighbourPossibleValues;
00123     //set<<3<<2<<5<<9;
00124     QSet<unsigned int>::const_iterator i = m_neighbourPossibleValues.constBegin();
00125     if (i == m_neighbourPossibleValues.constEnd()) // All possibles values (except
       0)
00126     {
00127         matchingNeighbours = c->countNeighbours();
00128     }
00129     else
00130     {
00131         while (i != m_neighbourPossibleValues.constEnd()) {
00132             //std::cout<<*i;
00133             matchingNeighbours += c->countNeighbours(*i);
00134             ++i;
00135         }
00136     }
00137     if(!inInterval(matchingNeighbours))
00138         return false; //the rule cannot be applied to the cell
00139
00140     return true; //the rule can be applied to the cell
00141
00142 }
00143
00146 QJsonObject NeighbourRule::toJson() const
00147 {
00148     QJsonObject object(Rule::toJson());
00149
00150     object.insert("type", QJsonValue("neighbour"));
00151     object.insert("neighbourNumberMin", QJsonValue((int)m_neighbourInterval.first));
00152     object.insert("neighbourNumberMax", QJsonValue((int)m_neighbourInterval.second));
00153
00154     QJsonArray neighbourState;
00155     for (QSet<unsigned int>::const_iterator it = m_neighbourPossibleValues.begin()
      ; it != m_neighbourPossibleValues.end(); ++it)
00156     {
00157         neighbourState.append(QJsonValue((int)*it));
00158     }
00159     object.insert("neighbourStates", neighbourState);
00160
00161     return object;
00162 }
```

8.33 neighbourrule.h File Reference

```
#include <QPair>
#include <QSet>
#include "cell.h"
#include "rule.h"
```

Classes

- class NeighbourRule

  Contains the rule condition and the output state if that condition is satisfied The rule modifies a cell depending on the number of its neighbours belonging to a range.

8.34 neighbourrule.h

```
00001 #ifndef NEIGHBOURRULE_H
00002 #define NEIGHBOURRULE_H
00003
00004 #include <QPair>
00005 #include <QSet>
00006 #include "cell.h"
00007 #include "rule.h"
00008
00013 class NeighbourRule : public Rule
```

```
00014 {
00015 protected:
00016     QPair<unsigned int , unsigned int> m_neighbourInterval;
00017     //ATTENTION check that first is lower than second
00018     QSet<unsigned int> m_neighbourPossibleValues;
00019     bool inInterval(unsigned int matchingNeighbours)const;
00020     //bool load(const QJsonObject &json);
00021 public:
00022     NeighbourRule(unsigned int outputState, QVector<unsigned int> currentCellValues,
      QPair<unsigned int, unsigned int> intervalNbrNeighbour, QSet<unsigned int> neighbourValues = QSet<unsigned int>());
00023     ~NeighbourRule();
00024     bool matchCell(const Cell * c)const;
00025
00026     QJsonObject toJson() const;
00027 };
00028
00029 #endif // NEIGHBOURRULE_H
```

8.35 presentation.md File Reference

8.36 presentation.md

```
00001 \page Presentation
00002 # What is AutoCell
00003 The purpose of this project is to create a Cellular Automate Simulator.
00004
00005 \includedoc CellHandler
```

8.37 README.md File Reference

8.38 README.md

```
00001 \mainpage
00002
00003 To generate the Documentation, go in Documentation directory and run `make`.
00004
00005 It will generate html doc (in `output/html/index.html`) and latex doc (pdf output directely in
       Documentation directory (`docPdf.pdf`).
```

8.39 rule.cpp File Reference

```
#include "rule.h"
```

8.40 rule.cpp

```
00001 #include "rule.h"
00002
00007 Rule::Rule(QVector<unsigned int> currentCellValues, unsigned int outputState):
00008         m_currentCellPossibleValues(currentCellValues), m_cellOutputState(outputState)
00009 {
00010
00011 }
00012
00015 QJsonObject Rule::toJson() const
00016 {
00017     QJsonObject object;
00018     object.insert("finalState", QJsonValue((int)m_cellOutputState));
```

```
00019
00020     QJsonArray currentStates;
00021     for (int i = 0; i < m_currentCellPossibleValues.size(); i++)
00022     {
00023         currentStates.append(QJsonValue((int)m_currentCellPossibleValues.at(i)))
      ;
00024     }
00025     object.insert("currentStates", currentStates);
00026
00027     return object;
00028 }
00029
00032 unsigned int Rule::getCellOutputState()const
00033 {
00034     return m_cellOutputState;
00035 }
00036
```

8.41 rule.h File Reference

```
#include <QVector>
#include <QJsonObject>
#include <QJsonArray>
#include "cell.h"
```

Classes

- class Rule

8.42 rule.h

```
00001 #ifndef RULE_H
00002 #define RULE_H
00003
00004 #include <QVector>
00005 #include <QJsonObject>
00006 #include <QJsonArray>
00007 #include "cell.h"
00008
00009
00013 class Rule
00014 {
00015 protected:
00016     QVector<unsigned int> m_currentCellPossibleValues;
00017     unsigned int m_cellOutputState;
00018 public:
00019     Rule(QVector<unsigned int> currentCellValues, unsigned int outputState);
00020
00021     virtual QJsonObject toJson() const = 0;
00022     virtual ~Rule(){}
00032     virtual bool matchCell(const Cell * c)const = 0;
00033     unsigned int getCellOutputState() const;
00034
00035 };
00036
00037 #endif // RULE_H
```

8.43 ruleeditor.cpp File Reference

```
#include "ruleeditor.h"
```

8.44 ruleeditor.cpp

```
00001 #include "ruleeditor.h"
00002
00006 RuleEditor::RuleEditor(unsigned int dimensions, QWidget *parent) : QDialog(parent),
      m_dimensions(dimensions)
00007 {
00008     QGridLayout *rulesInputLayout = new QGridLayout();
00009     QHBoxLayout *hlayout = new QHBoxLayout();
00010     if (m_dimensions > 1)
00011     {
00012         m_selectedRule = -1;
00013
00014         m_rulesListWidget = new QListWidget(this);
00015         QLabel *rulesLabel = new QLabel("Rules ",this);
00016         QVBoxLayout *rulesListLayout = new QVBoxLayout();
00017         rulesListLayout->addWidget(rulesLabel);
00018         rulesListLayout->addWidget(m_rulesListWidget);
00019         hlayout->addLayout(rulesListLayout);
00020
00021         rulesInputLayout->addWidget(new QLabel("Current cell values :",this),0,0);
00022         m_currentStatesEdit = new QLineEdit(this);
00023         QRegExp rgx("([0-9]+,)*");
00024         QRegExpValidator *v = new QRegExpValidator(rgx, this);
00025         m_currentStatesEdit->setValidator(v);
00026         rulesInputLayout->addWidget(m_currentStatesEdit,0,1);
00027
00028         rulesInputLayout->addWidget(new QLabel("Neighbour number lower bound :",this),1,0);
00029         m_lowerNeighbourBox = new QSpinBox(this);
00030         rulesInputLayout->addWidget(m_lowerNeighbourBox,1,1);
00031
00032         rulesInputLayout->addWidget(new QLabel("Neighbour number upper bound :",this),2,0);
00033         m_upperNeighbourBox = new QSpinBox(this);
00034         rulesInputLayout->addWidget(m_upperNeighbourBox,2,1);
00035
00036         rulesInputLayout->addWidget(new QLabel("Neighbour values :",this),3,0);
00037         m_neighbourStatesEdit = new QLineEdit(this);
00038         m_neighbourStatesEdit->setValidator(v);
00039         rulesInputLayout->addWidget(m_neighbourStatesEdit,3,1);
00040
00041         rulesInputLayout->addWidget(new QLabel("Output state :",this),4,0);
00042         m_outputStateBox = new QSpinBox(this);
00043         rulesInputLayout->addWidget(m_outputStateBox,4,1);
00044     }
00045     else
00046     {
00047         rulesInputLayout->addWidget(new QLabel("Automaton number :",this),0,0);
00048         m_automatonNumber = new QSpinBox(this);
00049         m_automatonNumber->setMaximum(255);
00050         m_automatonNumber->setMinimum(0);
00051         rulesInputLayout->addWidget(m_automatonNumber,0,1);
00052     }
00053
00054     hlayout->addLayout(rulesInputLayout);
00055     QVBoxLayout* mainLayout = new QVBoxLayout();
00056     QHBoxLayout* buttonLayout = new QHBoxLayout();
00057
00058     if (dimensions > 1)
00059     {
00060         m_addBt = new QPushButton("Add Rule",this);
00061         m_importBt = new QPushButton("Import Rule file",this);
00062         m_removeBt = new QPushButton("Remove Rule",this);
00063         buttonLayout->addWidget(m_importBt);
00064         buttonLayout->addWidget(m_addBt);
00065         buttonLayout->addWidget(m_removeBt);
00066     }
00067     m_doneBt = new QPushButton("Done !",this);
00068
00069
00070     buttonLayout->addWidget(m_doneBt);
00071
00072     mainLayout->addLayout(hlayout);
00073     mainLayout->addLayout(buttonLayout);
00074     setLayout(mainLayout);
00075
00076     if (dimensions > 1)
00077     {
00078         connect(m_addBt, SIGNAL(clicked(bool)), this, SLOT(addRule()));
00079         connect(m_importBt, SIGNAL(clicked(bool)), this, SLOT(
      importFile()));
00080         connect(m_removeBt, SIGNAL(clicked(bool)), this, SLOT(
      removeRule()));
00081     }
00082     connect(m_doneBt, SIGNAL(clicked(bool)), this, SLOT(sendRules()));
00083
00084 }
```

```
00085
00086
00089 void RuleEditor::addRule(){
00090     unsigned int outputState = m_outputStateBox->value();
00091     QVector<unsigned int> currentCellValues;
00092     QStringList valList = m_currentStatesEdit->text().split(",");
00093     for(int i = 0; i < valList.size(); i++) currentCellValues.append(valList.at(i).toInt());
00094
00095     QPair<unsigned int, unsigned int> neighbourInterval;
00096     neighbourInterval.first = m_lowerNeighbourBox->value();
00097     neighbourInterval.second = m_upperNeighbourBox->value();
00098
00099     QSet<unsigned int> neighbourValues;
00100     valList = m_neighbourStatesEdit->text().split(",");
00101     for(int i = 0; i < valList.size(); i++) neighbourValues << valList.at(i).toInt();
00102
00103     m_rules.append(new NeighbourRule(outputState,currentCellValues,neighbourInterval,
      neighbourValues));
00104
00105     QString listLabel = m_currentStatesEdit->text()+" -> "+QString::number(
      m_outputStateBox->value())
00106                         +" if "+QString::number(m_lowerNeighbourBox->value())+" to "+
00107                         QString::number(m_upperNeighbourBox->value())+" neighbours are
       in states "+
00108                         m_neighbourStatesEdit->text();
00109     m_rulesListWidget->addItem(listLabel);
00110 }
00111
00114 void RuleEditor::removeRule(){
00115     m_rules.removeAt(m_rulesListWidget->currentRow());
00116     delete m_rulesListWidget->takeItem(m_rulesListWidget->currentRow());
00117 }
00118
00121 void RuleEditor::sendRules(){
00122     if (m_dimensions == 1)
00123     {
00124         QList<const Rule*> ruleList = generate1DRules(
      m_automatonNumber->value());
00125         for (const Rule* rule : ruleList) // C++11
00126         {
00127             m_rules.append(rule);
00128         }
00129
00130     }
00131     emit rulesFilled(m_rules);
00132     this->close();
00133 }
00134
00137 void RuleEditor::importFile(){
00138     QString fileName = QFileDialog::getOpenFileName(this, tr("Open Rule file"), ".",
00139                                                     tr("Automaton rule files (*.atr)"));
00140     if(!fileName.isEmpty()){
00141         emit fileImported(fileName);
00142         this->close();
00143     }
00144 }
```

8.45 ruleeditor.h File Reference

```
#include <QtWidgets>
#include "neighbourrule.h"
#include "automate.h"
```

Classes

- class RuleEditor

  Dialog for editing the rules.

8.46 ruleeditor.h

```
00001 #ifndef RULEEDITOR_H
00002 #define RULEEDITOR_H
00003 #include <QtWidgets>
00004 #include "neighbourrule.h"
00005 #include "automate.h"
00006
00009 class RuleEditor : public QDialog
00010 {
00011     Q_OBJECT
00012     QList<const Rule*> m_rules;
00013     QListWidget* m_rulesListWidget;
00014     QTableWidget* m_rulesTable;
00015
00016     QSpinBox* m_outputStateBox;
00017     QLineEdit* m_currentStatesEdit;
00018     QLineEdit* m_neighbourStatesEdit;
00019     QSpinBox* m_upperNeighbourBox;
00020     QSpinBox* m_lowerNeighbourBox;
00021     QSpinBox* m_automatonNumber;
00022
00023     QPushButton* m_addBt;
00024     QPushButton* m_doneBt;
00025     QPushButton* m_removeBt;
00026     QPushButton* m_importBt;
00027
00028     unsigned int m_selectedRule;
00029     unsigned int m_dimensions;
00030
00031
00032 public:
00033     explicit RuleEditor(unsigned int dimensions, QWidget *parent = nullptr);
00034
00035 signals:
00036     void rulesFilled(QList<const Rule*> rules);
00037     void fileImported(QString path);
00038
00039 public slots:
00040     void removeRule();
00041     void addRule();
00042     void importFile();
00043     void sendRules();
00044
00045
00046 };
00047
00048 #endif // RULEEDITOR_H
```

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