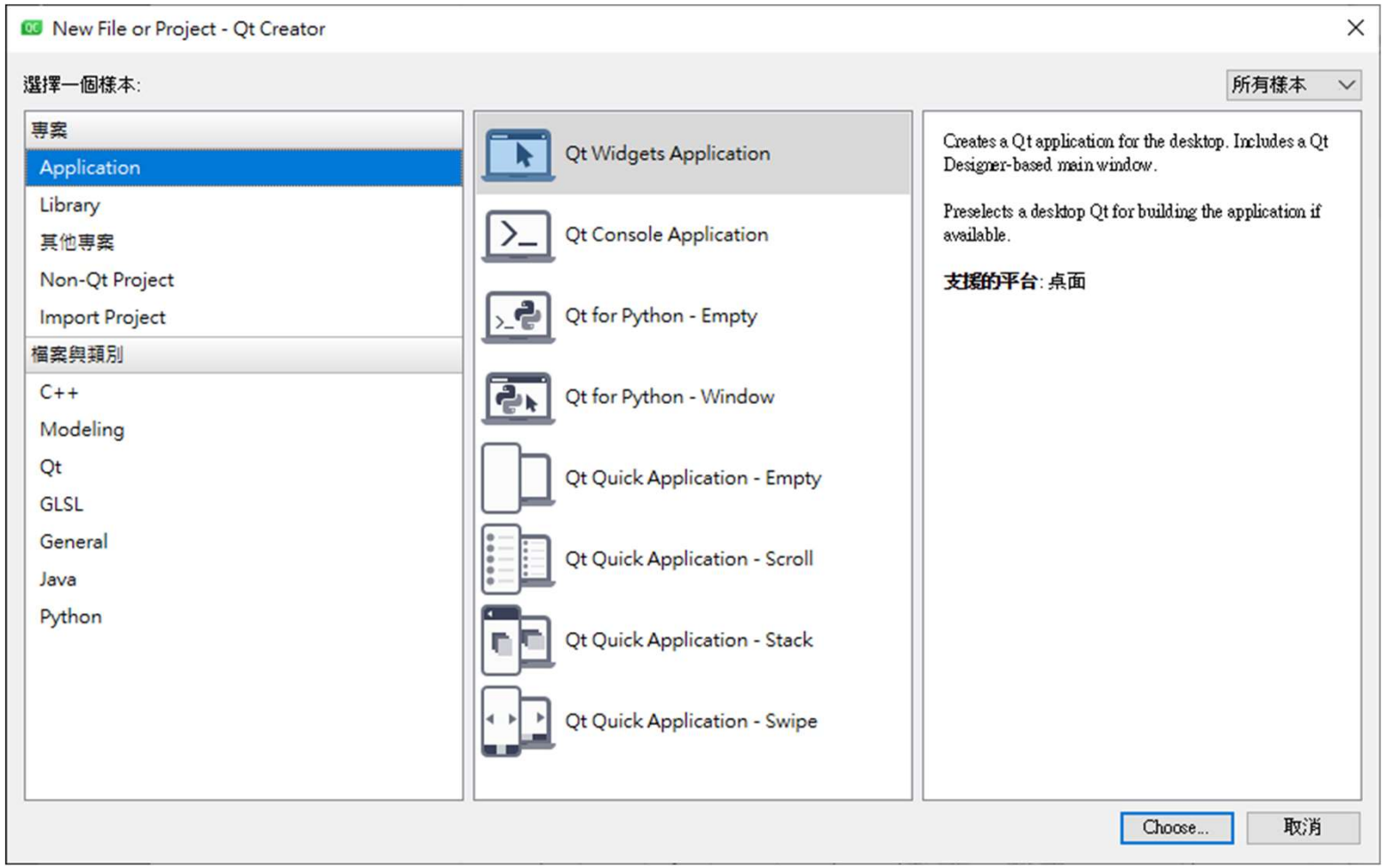
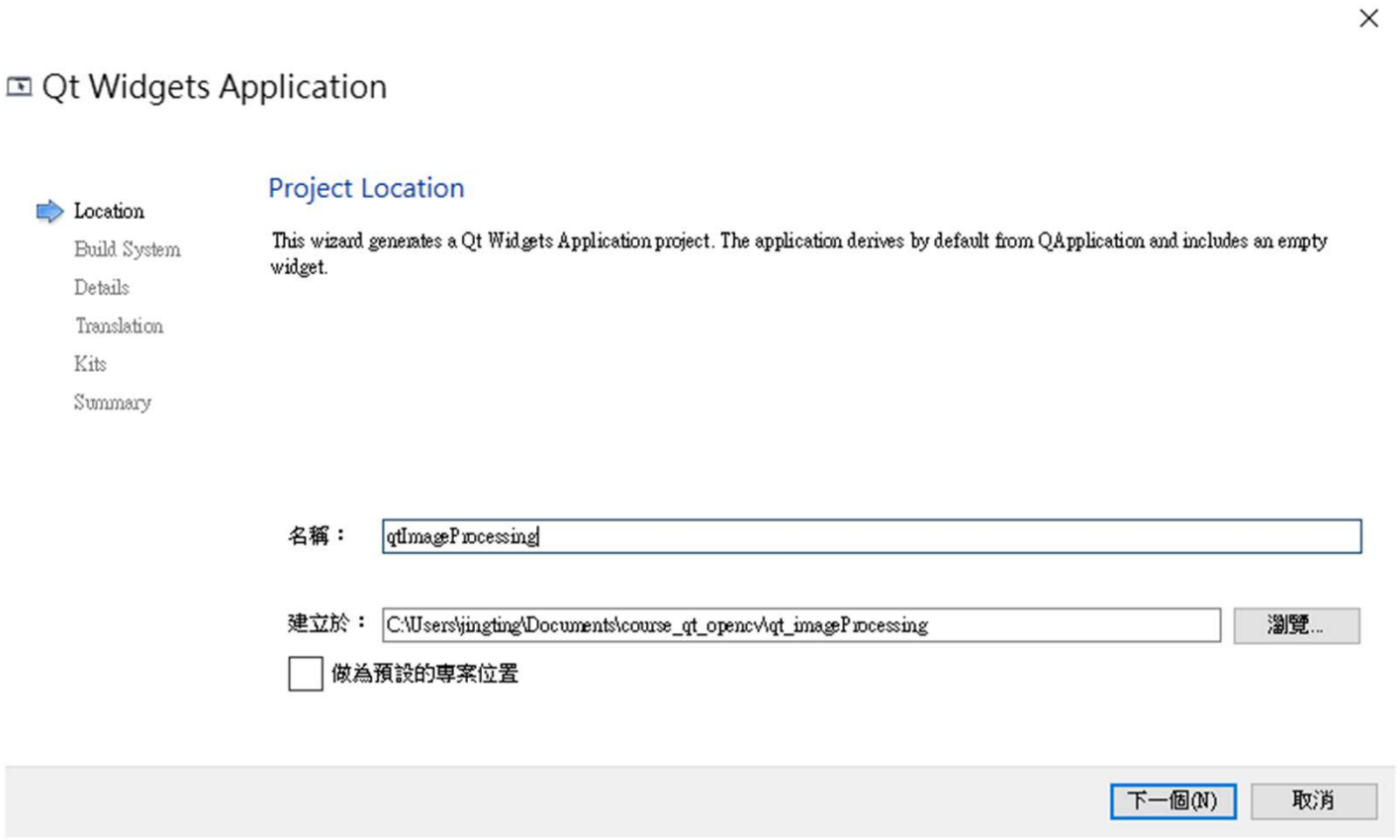
QT 影像處理

利用QT建立一個基本的影像處理程式

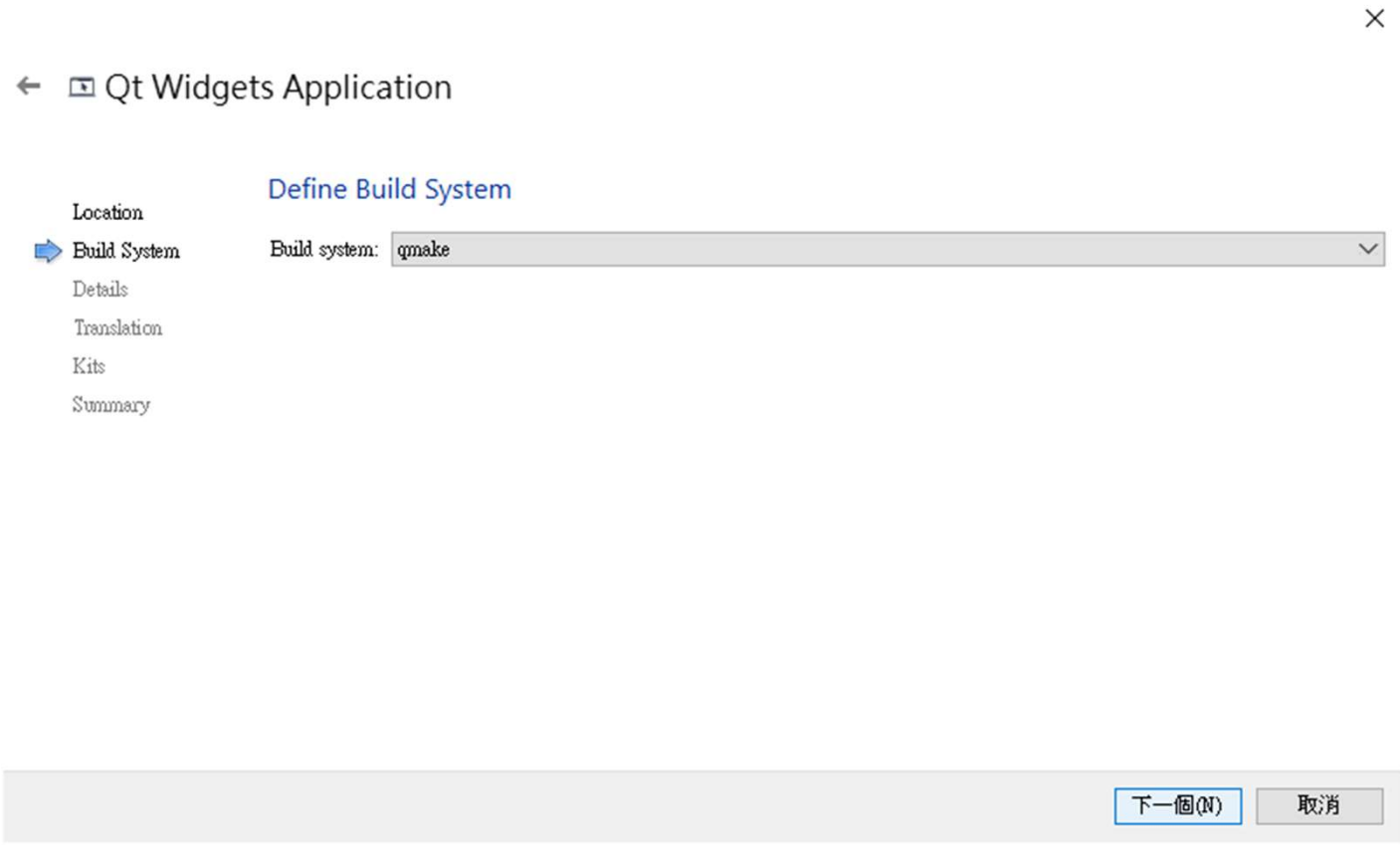
/course/101001001/c/course_qt_ImagePcocessing

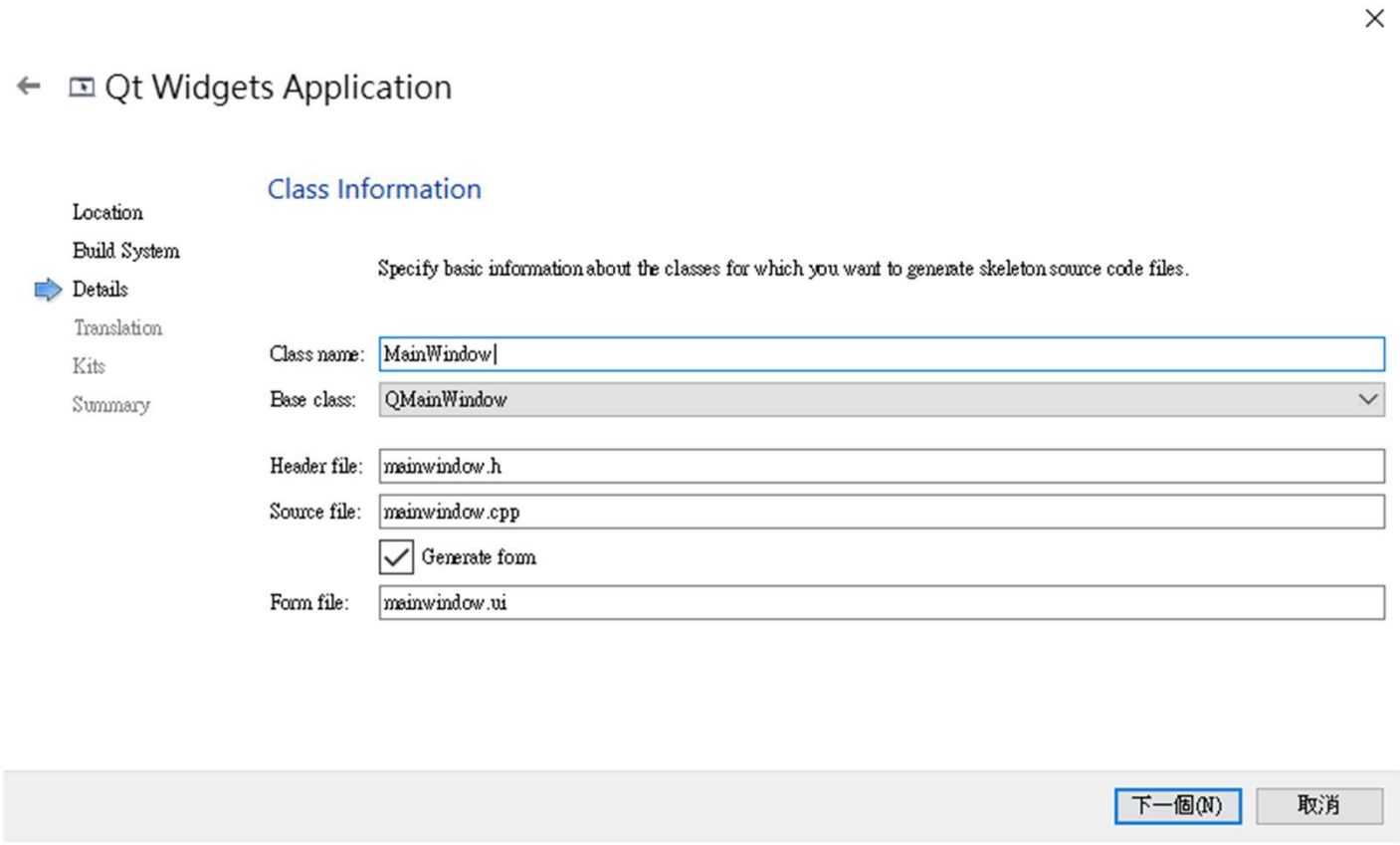
1. 建立專案

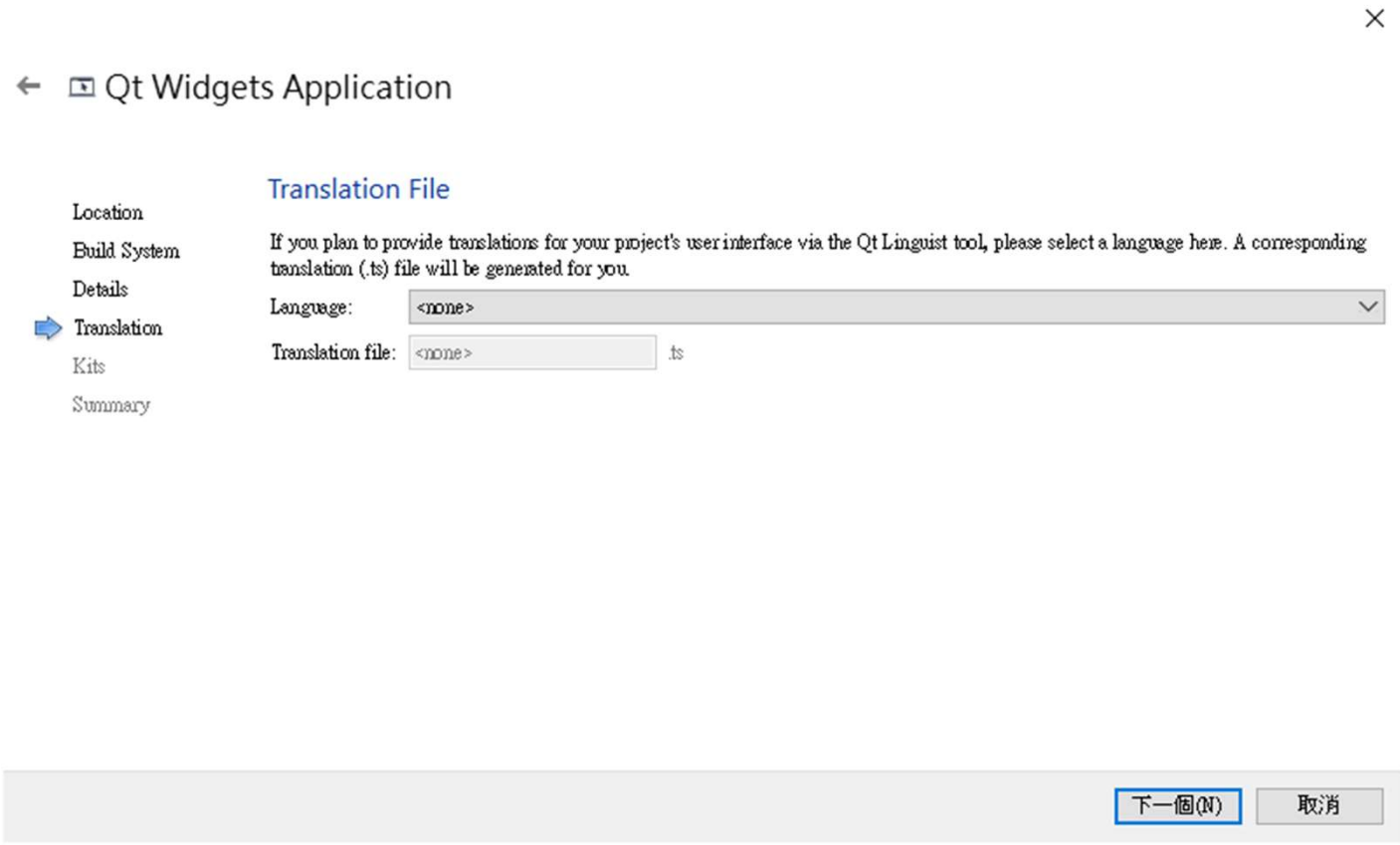

New File or Project - Qt Creator
選擇一個樣本:
所有樣本
專案
Application
Library
其他專案
Non-Qt Project
Import Project
檔案與類別
C++
Modeling
Qt
GLSL
General
Java
Python
Qt Widgets Application
Qt Console Application
Qt for Python - Empty
Qt for Python - Window
Qt Quick Application - Empty
Qt Quick Application - Scroll
Qt Quick Application - Stack
Qt Quick Application - Swipe
Creates a Qt application for the desktop. Includes a Qt Designer-based main window.
Preselects a desktop Qt for building the application if available.
支援的平台: 桌面
Choose...
取消

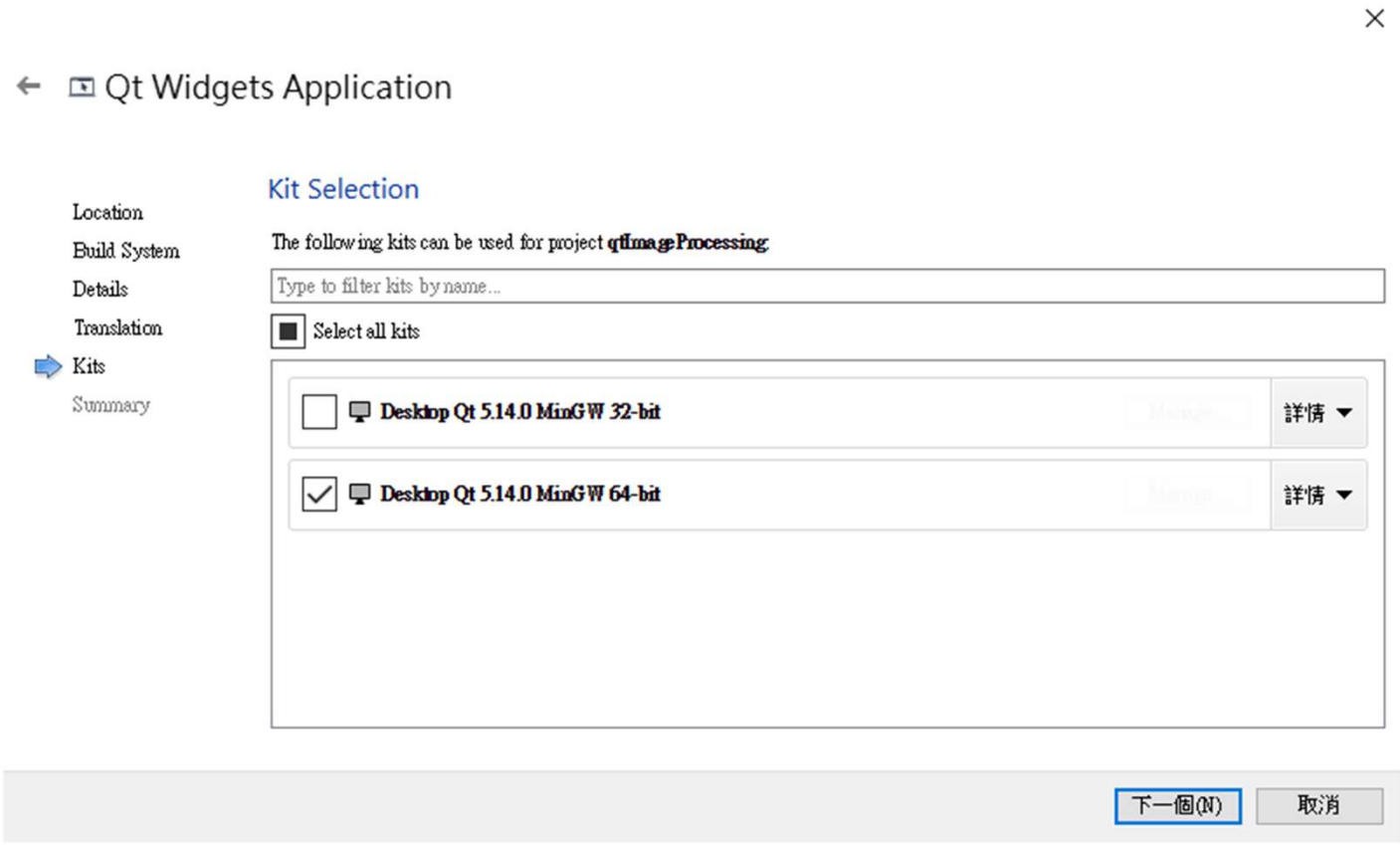


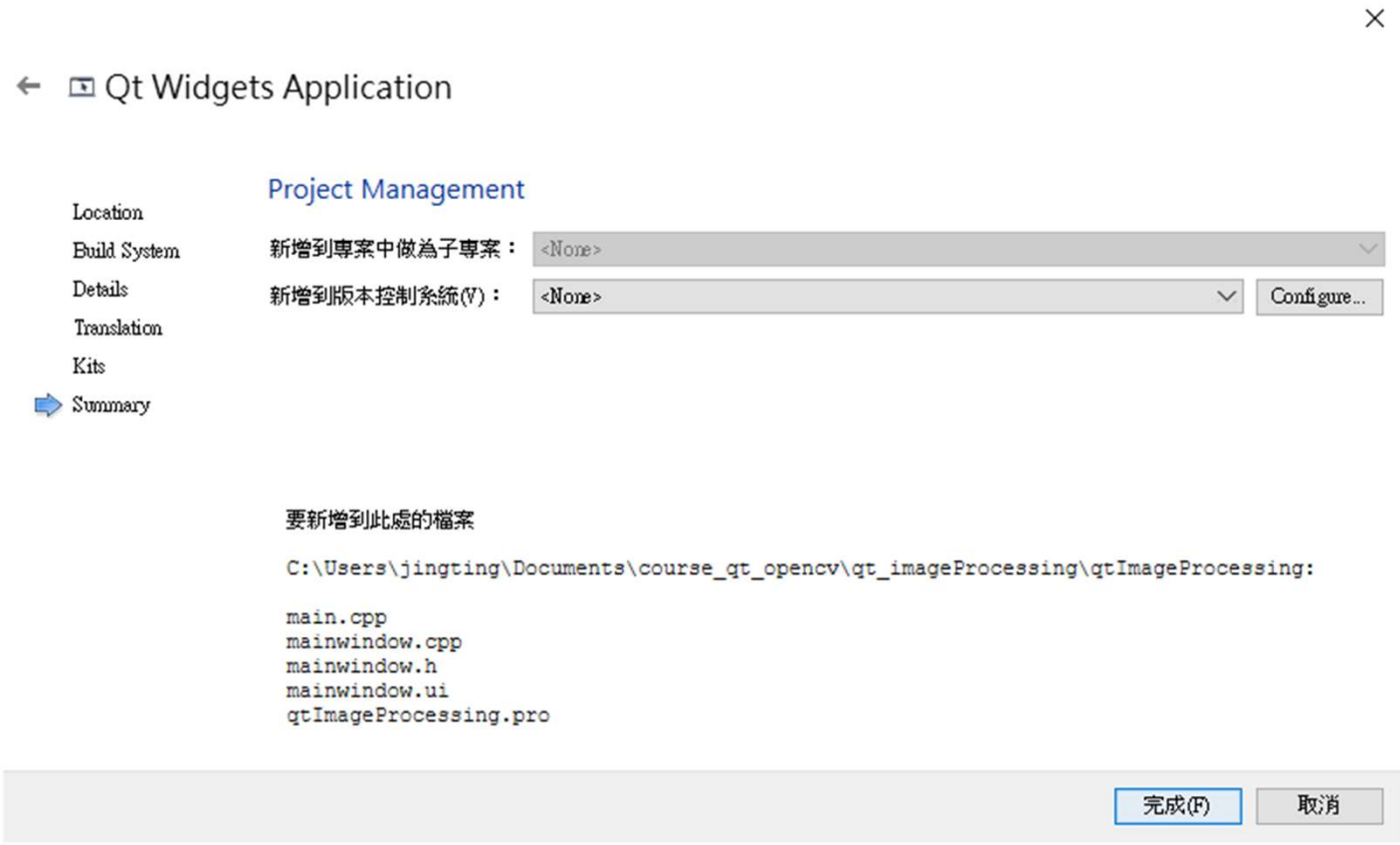
/course/101001001/c/course_qt_ImagePcocessing

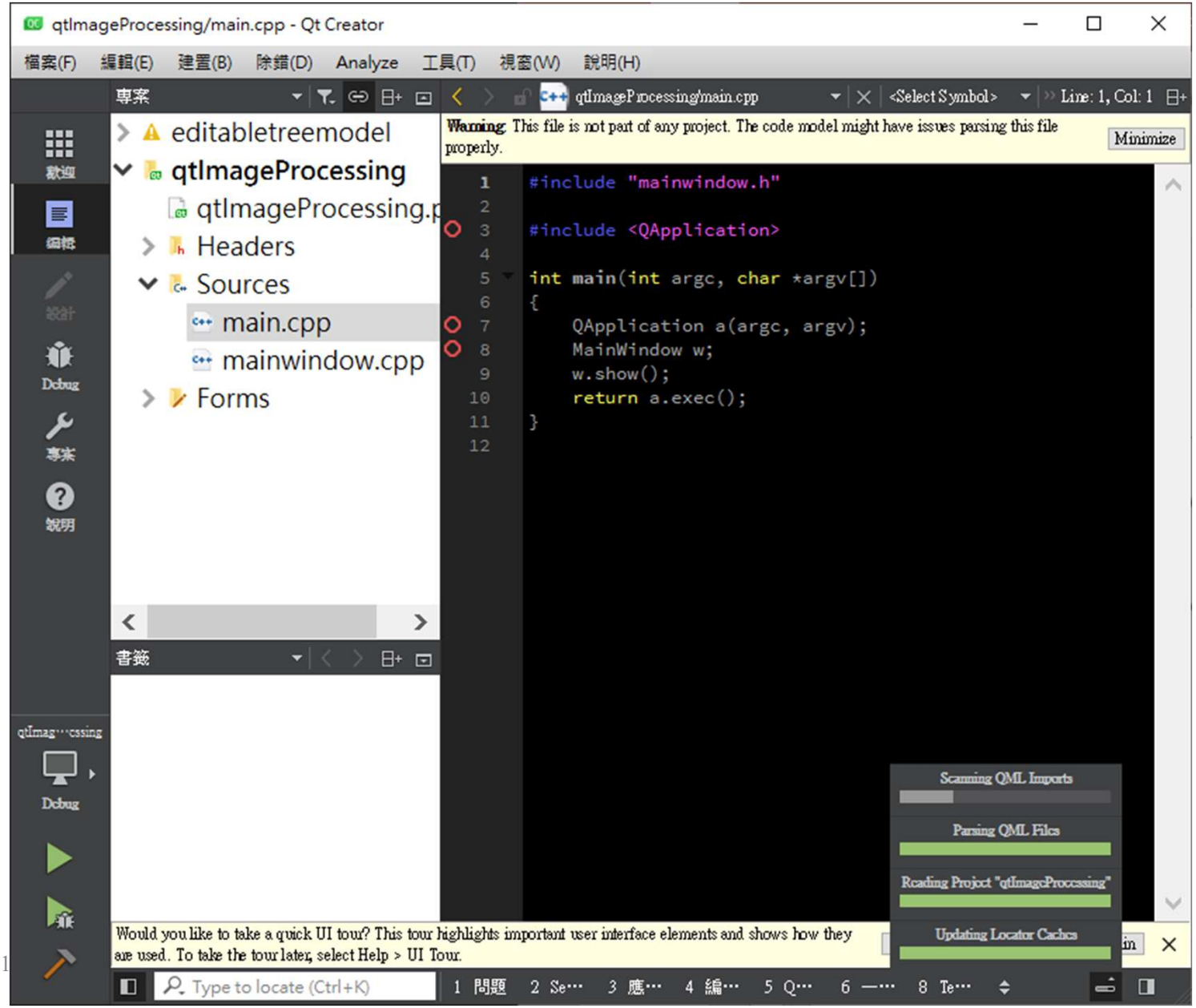

Qt Widgets Application
Location
Build System
Details
Translation
Kits
Summary
Define Build System
Build system:
qmake
下一個(N)
取消

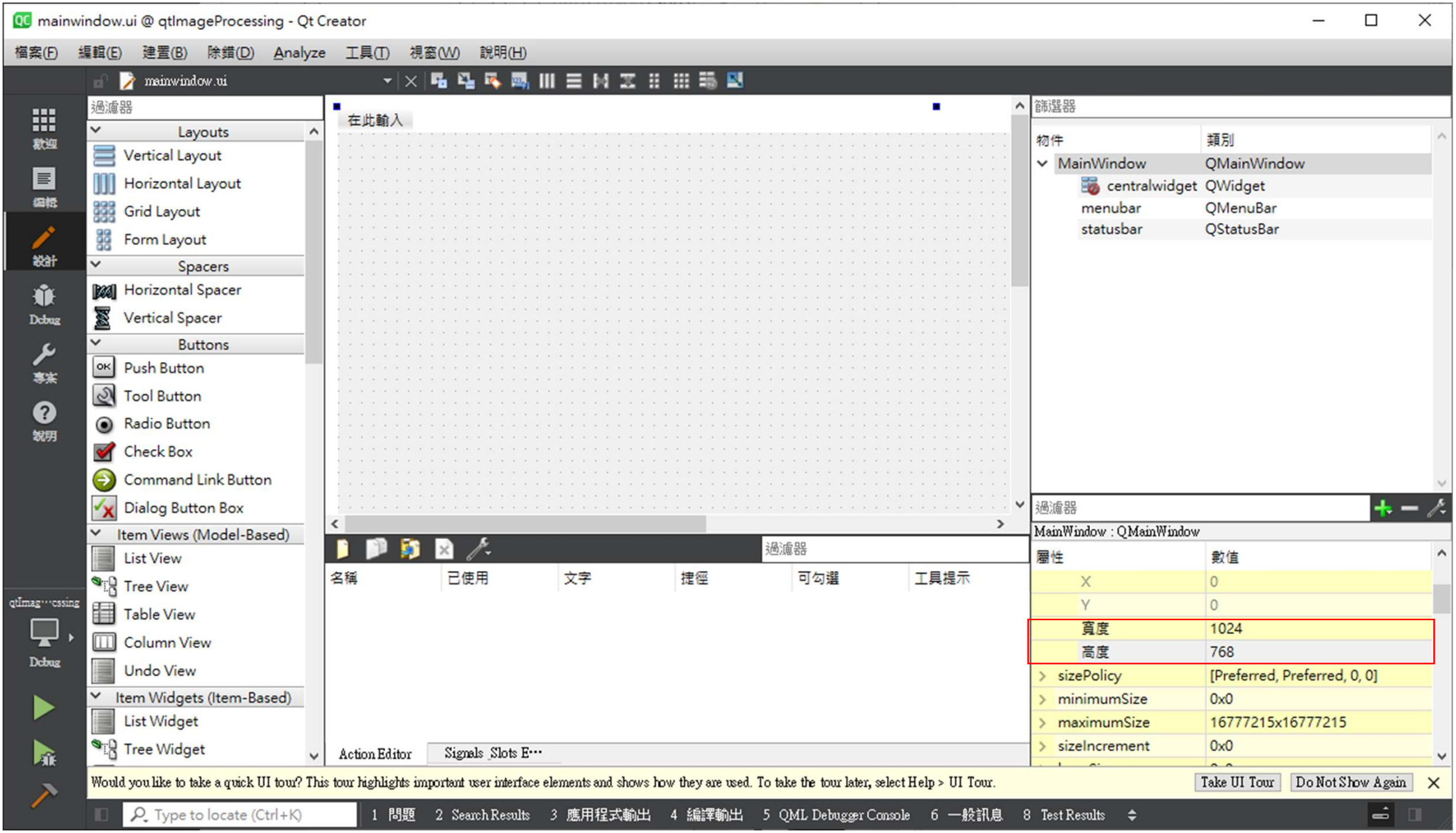

Qt Widgets Application
Location
Build System
Details
Translation
Kits
Summary
Class Information
Specify basic information about the classes for which you want to generate skeleton source code files.
Class name:
MainWindow
Base class:
QMainWindow
Header file:
mainwindow.h
Source file:
mainwindow.cpp
Generate form
Form file:
mainwindow.ui
下一個(N)
取消

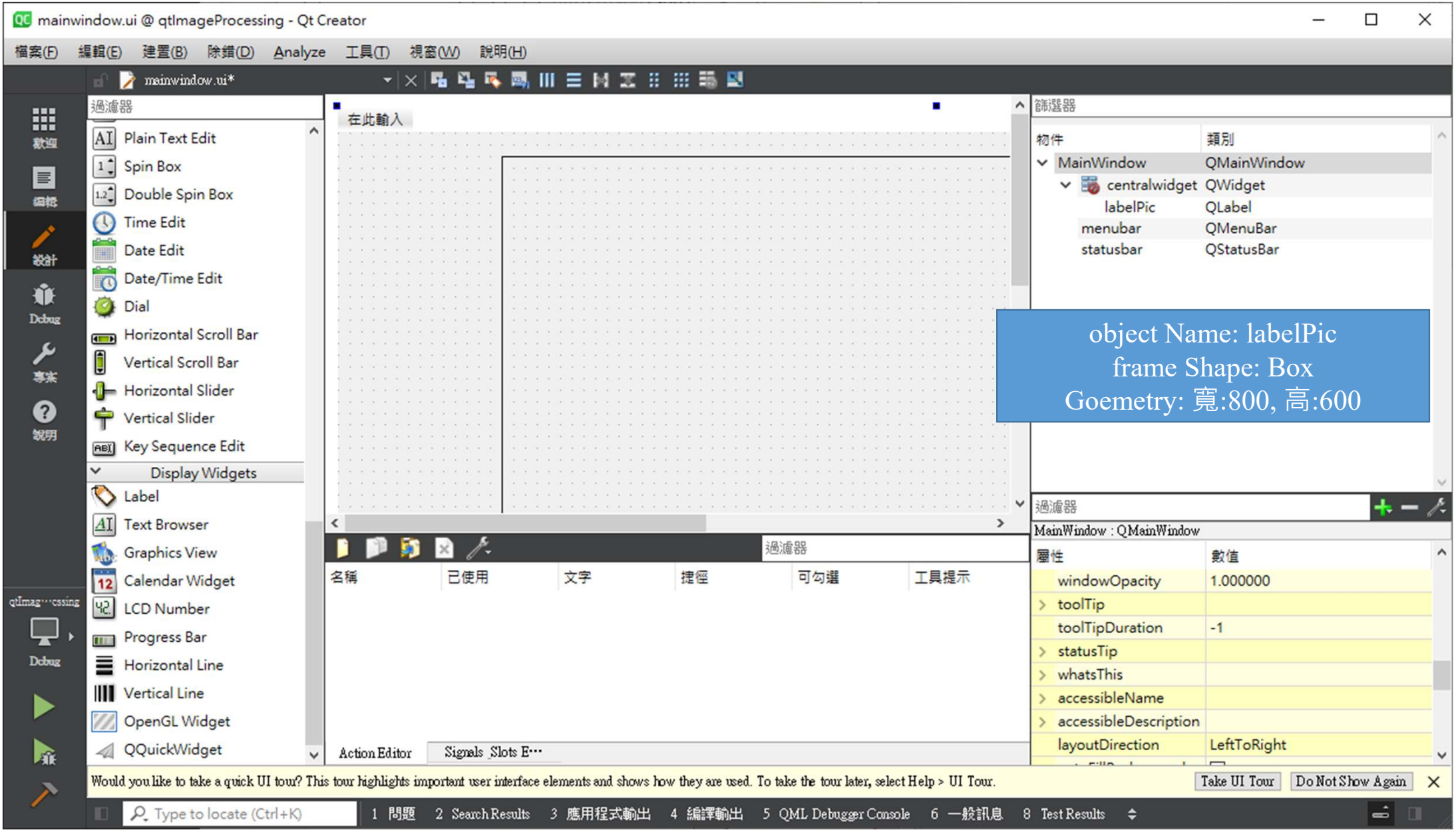

Qt Widgets Application
Location
Build System
Details
Translation
Kits
Summary
Translation File
If you plan to provide translations for your project's user interface via the Qt Linguist tool, please select a language here. A corresponding translation (.ts) file will be generated for you.
Language:
<none>
Translation file:
<none>
.ts
下一個(N)
取消


Qt Widgets Application
Location
Build System
Details
Translation
Kits
Summary
Kit Selection
The following kits can be used for project qtImageProcessing:
Type to filter kits by name...
Select all kits
Desktop Qt 5.14.0 MinGW 32-bit
詳情
Desktop Qt 5.14.0 MinGW 64-bit
詳情
下一個(N)
取消


Qt Widgets Application
Location
Build System
Details
Translation
Kits
Summary
Project Management
新增到專案中做為子專案：
<None>
新增到版本控制系統(V)：
<None>
Configure...
要新增到此處的檔案
C:\Users\jingting\Documents\course_qt_opencv\qt_imageProcessing\qtImageProcessing:
main.cpp
mainwindow.cpp
mainwindow.h
mainwindow.ui
qtImageProcessing.pro
完成(F)
取消




mainwindow.ui @ qtImageProcessing - Qt Creator
檔案(F) 編輯(E) 建置(B) 除錯(D) Analyze 工具(T) 視窗(W) 說明(H)
mainwindow.ui
過濾器
Layouts
Vertical Layout
Horizontal Layout
Grid Layout
Form Layout
Spacers
Horizontal Spacer
Vertical Spacer
Buttons
Push Button
Tool Button
Radio Button
Check Box
Command Link Button
Dialog Button Box
Item Views (Model-Based)
List View
Tree View
Table View
Column View
Undo View
Item Widgets (Item-Based)
List Widget
Tree Widget
在此輸入
名稱 已使用 文字 捷徑 可勾選 工具提示
Action Editor
Signals Slots E…
篩選器
物件 類別
MainWindow QMainWindow
centralwidget QWidget
menubar QMenuBar
statusbar QStatusBar
MainWindow : QMainWindow
屬性 數值
X 0
Y 0
寬度 1024
高度 768
sizePolicy [Preferred, Preferred, 0, 0]
minimumSize 0x0
maximumSize 16777215x16777215
sizeIncrement 0x0
Would you like to take a quick UI tour? This tour highlights important user interface elements and shows how they are used. To take the tour later, select Help > UI Tour.
Take UI Tour
Do Not Show Again
Type to locate (Ctrl+K)
1 問題 2 Search Results 3 應用程式輸出 4 編譯輸出 5 QML Debugger Console 6 一般訊息 8 Test Results


mainwindow.ui @ qtImageProcessing - Qt Creator
檔案(F) 編輯(E) 建置(B) 除錯(D) Analyze 工具(T) 視窗(W) 說明(H)
mainwindow.ui*
過濾器
Plain Text Edit
Spin Box
Double Spin Box
Time Edit
Date Edit
Date/Time Edit
Dial
Horizontal Scroll Bar
Vertical Scroll Bar
Horizontal Slider
Vertical Slider
Key Sequence Edit
Display Widgets
Label
Text Browser
Graphics View
Calendar Widget
LCD Number
Progress Bar
Horizontal Line
Vertical Line
OpenGL Widget
QQuickWidget
在此輸入
篩選器
物件
類別
MainWindow
QMainWindow
centralwidget
QWidget
labelPic
QLabel
menubar
QMenuBar
statusbar
QStatusBar
object Name: labelPic
frame Shape: Box
Goemetry: 寬:800, 高:600
過濾器
MainWindow : QMainWindow
屬性
數值
windowOpacity
1.000000
toolTip
toolTipDuration
-1
statusTip
whatsThis
accessibleName
accessibleDescription
layoutDirection
LeftToRight
名稱
已使用
文字
捷徑
可勾選
工具提示
Action Editor
Signals Slots E…
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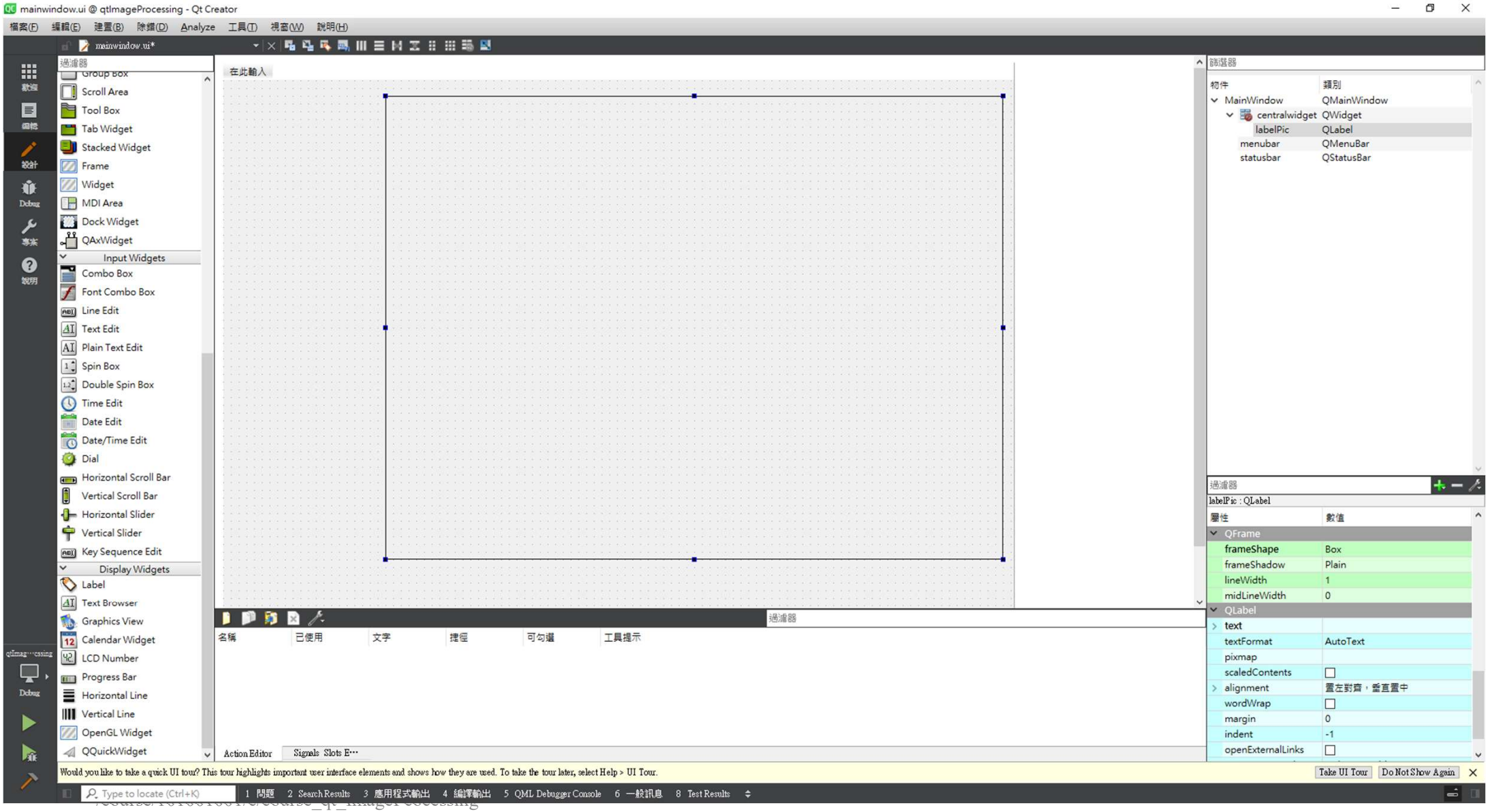
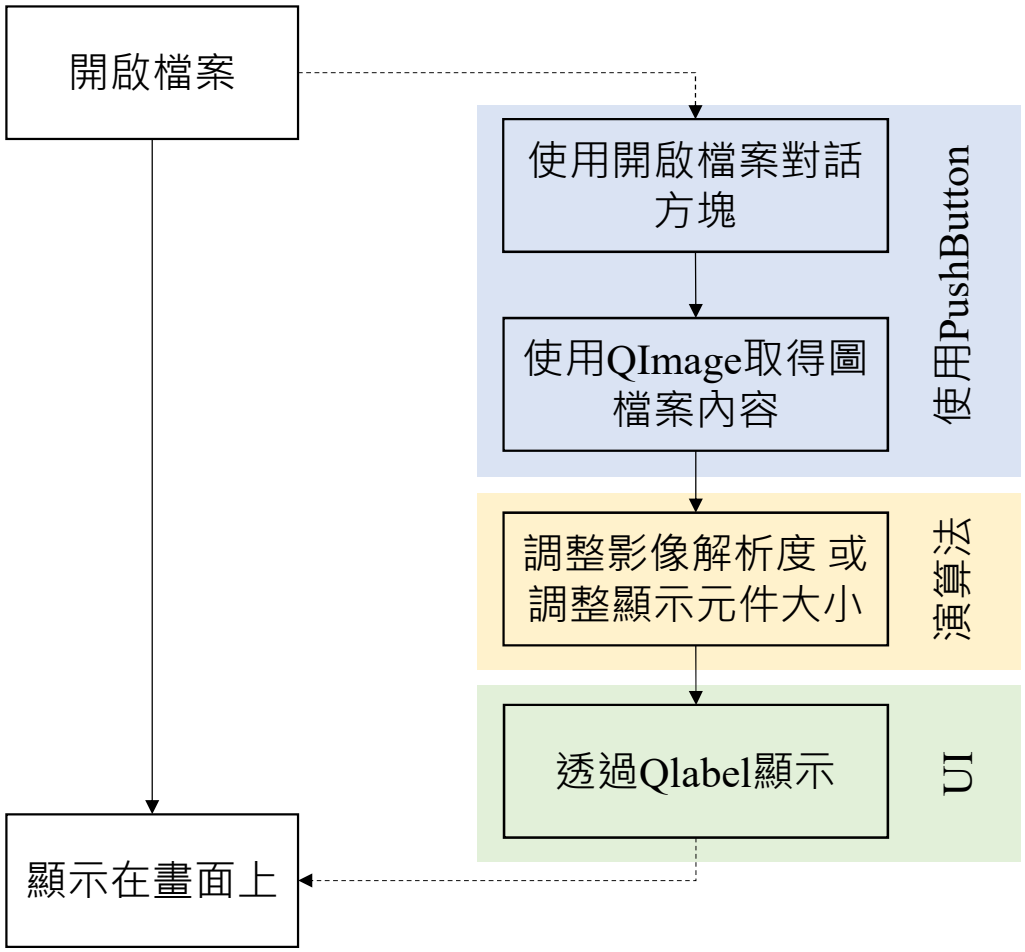
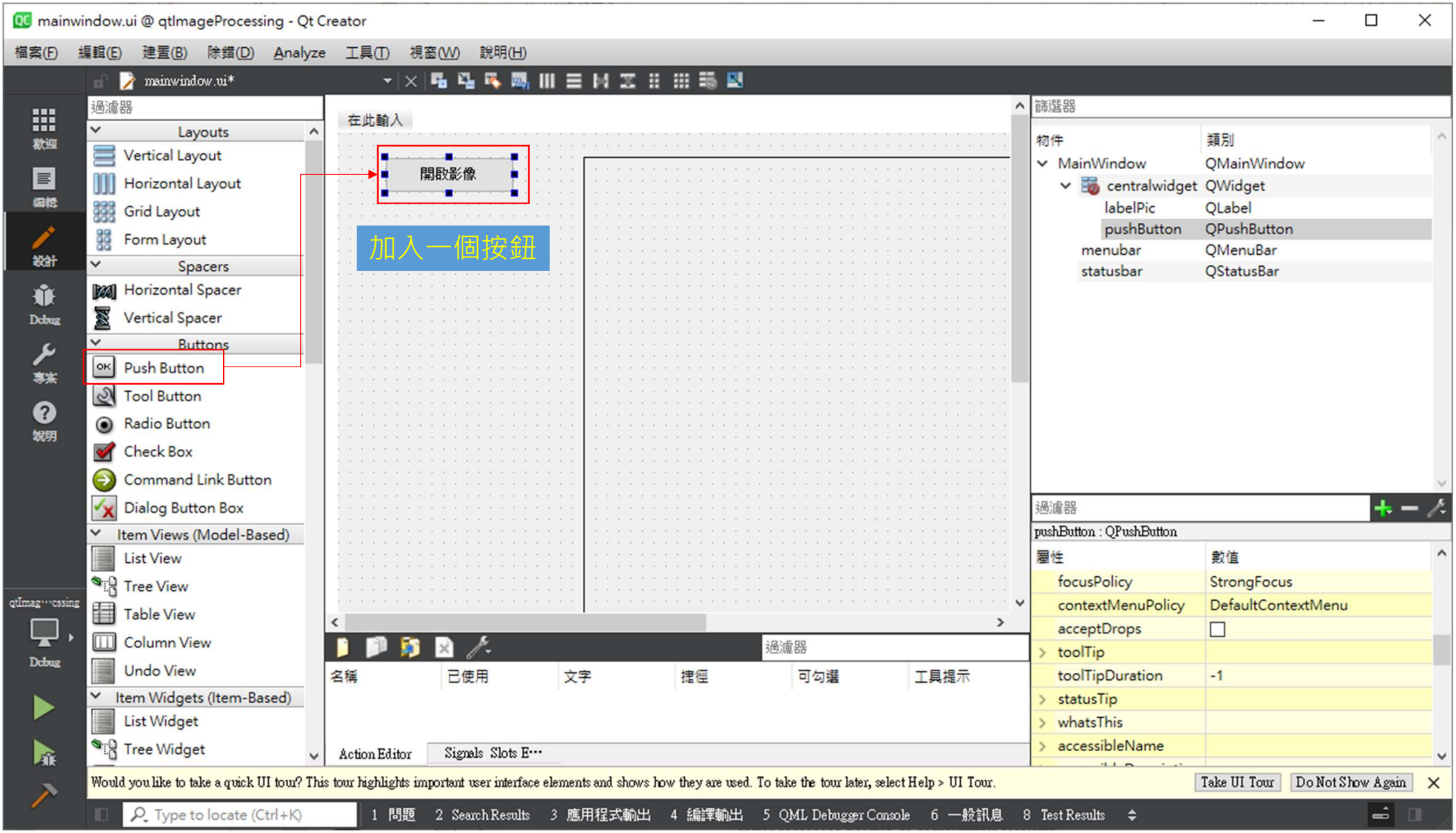
3 應用程式輸出
4 編譯輸出
5 QML Debugger Console
6 一般訊息
8 Test Results

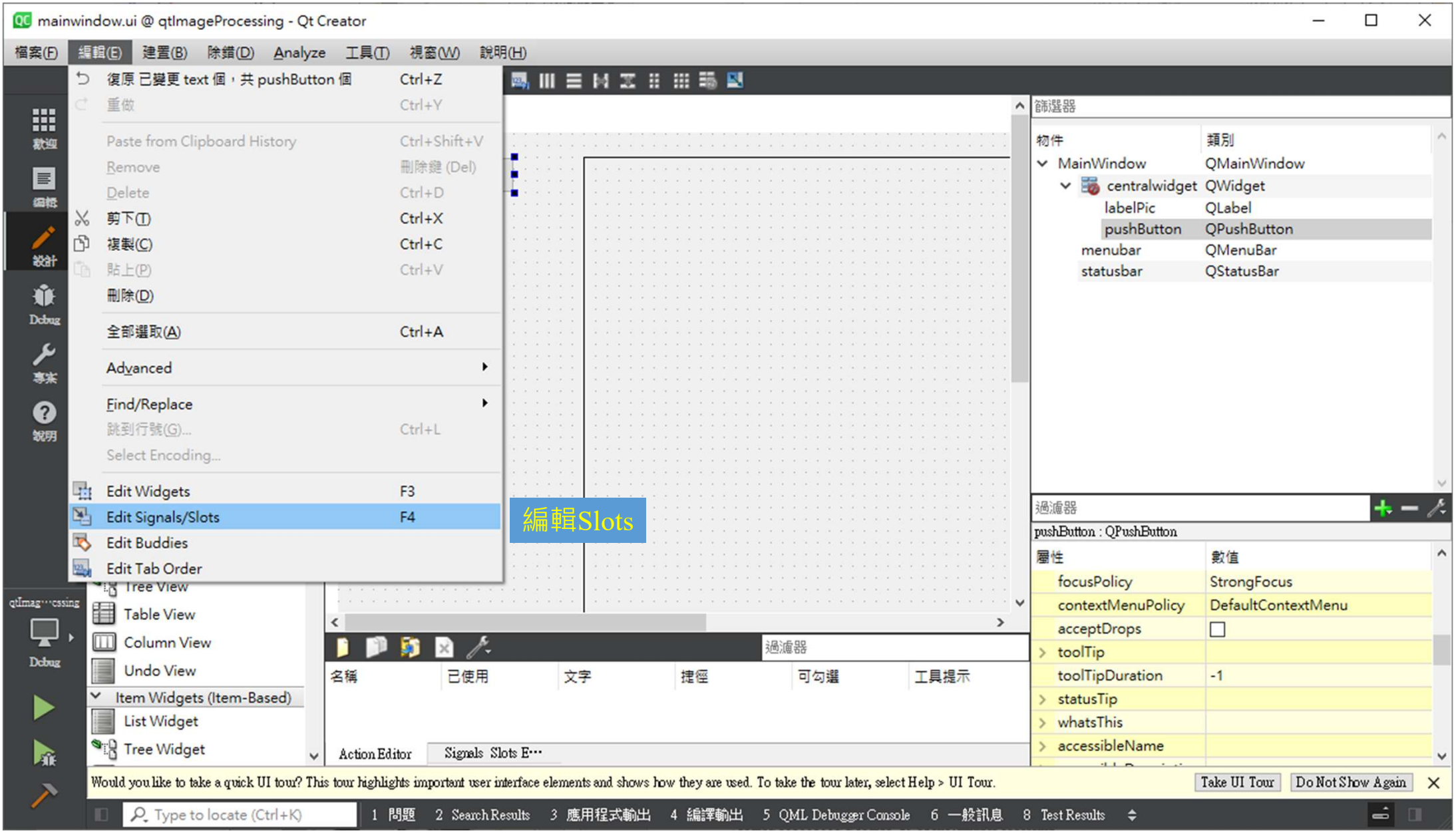

mainwindow.ui @ qtImageProcessing - Qt Creator
檔案(F) 編輯(E) 建置(B) 除錯(D) Analyze 工具(T) 視窗(W) 說明(H)
mainwindow.ui*
過濾器
Group Box
Scroll Area
Tool Box
Tab Widget
Stacked Widget
Frame
Widget
MDI Area
Dock Widget
QAxWidget
Input Widgets
Combo Box
Font Combo Box
Line Edit
Text Edit
Plain Text Edit
Spin Box
Double Spin Box
Time Edit
Date Edit
Date/Time Edit
Dial
Horizontal Scroll Bar
Vertical Scroll Bar
Horizontal Slider
Vertical Slider
Key Sequence Edit
Display Widgets
Label
Text Browser
Graphics View
Calendar Widget
LCD Number
Progress Bar
Horizontal Line
Vertical Line
OpenGL Widget
QQuickWidget
在此輸入
過濾器
名稱 已使用 文字 捷徑 可勾選 工具提示
Action Editor Signals Slots E…
篩選器
物件 類別
MainWindow QMainWindow
centralwidget QWidget
labelPic QLabel
menubar QMenuBar
statusbar QStatusBar
過濾器
labelPic : QLabel
屬性 數值
QFrame
frameShape Box
frameShadow Plain
lineWidth 1
midLineWidth 0
QLabel
text
textFormat AutoText
pixmap
scaledContents
alignment 置左對齊，垂直置中
wordWrap
margin 0
indent -1
openExternalLinks
Would you like to take a quick UI tour? This tour highlights important user interface elements and shows how they are used. To take the tour later, select Help > UI Tour.
Take UI Tour
Do Not Show Again
Type to locate (Ctrl+K)
1 問題 2 Search Results 3 應用程式輸出 4 編譯輸出 5 QML Debugger Console 6 一般訊息 8 Test Results

/course/101001001/c/course_qt_ImagePcocessing

利用QT元件QImage開啟影像並顯示在畫面上


開啟檔案
使用開啟檔案對話方塊
使用QImage取得圖檔案內容
使用PushButton
調整影像解析度 或 調整顯示元件大小
演算法
透過Qlabel顯示
UI
顯示在畫面上


mainwindow.ui @ qtImageProcessing - Qt Creator
檔案(F) 編輯(E) 建置(B) 除錯(D) Analyze 工具(T) 視窗(W) 說明(H)
mainwindow.ui*
過濾器
Layouts
Vertical Layout
Horizontal Layout
Grid Layout
Form Layout
Spacers
Horizontal Spacer
Vertical Spacer
Buttons
Push Button
Tool Button
Radio Button
Check Box
Command Link Button
Dialog Button Box
Item Views (Model-Based)
List View
Tree View
Table View
Column View
Undo View
Item Widgets (Item-Based)
List Widget
Tree Widget
在此輸入
開啟影像
加入一個按鈕
篩選器
物件
類別
MainWindow
QMainWindow
centralwidget
QWidget
labelPic
QLabel
pushButton
QPushButton
menubar
QMenuBar
statusbar
QStatusBar
過濾器
pushButton : QPushButton
屬性
數值
focusPolicy
StrongFocus
contextMenuPolicy
DefaultContextMenu
acceptDrops
toolTip
toolTipDuration
-1
statusTip
whatsThis
accessibleName
名稱
已使用
文字
捷徑
可勾選
工具提示
Action Editor
Signals Slots E…
Would you like to take a quick UI tour? This tour highlights important user interface elements and shows how they are used. To take the tour later, select Help > UI Tour.
Take UI Tour
Do Not Show Again
Type to locate (Ctrl+K)
1 問題
2 Search Results
3 應用程式輸出
4 編譯輸出
5 QML Debugger Console
6 一般訊息
8 Test Results


mainwindow.ui @ qtImageProcessing - Qt Creator
檔案(F)
編輯(E)
建置(B)
除錯(D)
Analyze
工具(T)
視窗(W)
說明(H)
復原 已變更 text 個，共 pushButton 個 Ctrl+Z
重做 Ctrl+Y
Paste from Clipboard History Ctrl+Shift+V
Remove 刪除鍵 (Del)
Delete Ctrl+D
剪下(T) Ctrl+X
複製(C) Ctrl+C
貼上(P) Ctrl+V
刪除(D)
全部選取(A) Ctrl+A
Advanced
Find/Replace
跳到行號(G)... Ctrl+L
Select Encoding...
Edit Widgets F3
Edit Signals/Slots F4
Edit Buddies
Edit Tab Order
編輯Slots
歡迎
編輯
設計
Debug
專案
說明
Tree View
Table View
Column View
Undo View
Item Widgets (Item-Based)
List Widget
Tree Widget
篩選器
物件
類別
MainWindow
QMainWindow
centralwidget
QWidget
labelPic
QLabel
pushButton
QPushButton
menubar
QMenuBar
statusbar
QStatusBar
過濾器
pushButton : QPushButton
屬性
數值
focusPolicy
StrongFocus
contextMenuPolicy
DefaultContextMenu
acceptDrops
toolTip
toolTipDuration
-1
statusTip
whatsThis
accessibleName
名稱
已使用
文字
捷徑
可勾選
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Action Editor
Signals Slots E…
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Do Not Show Again
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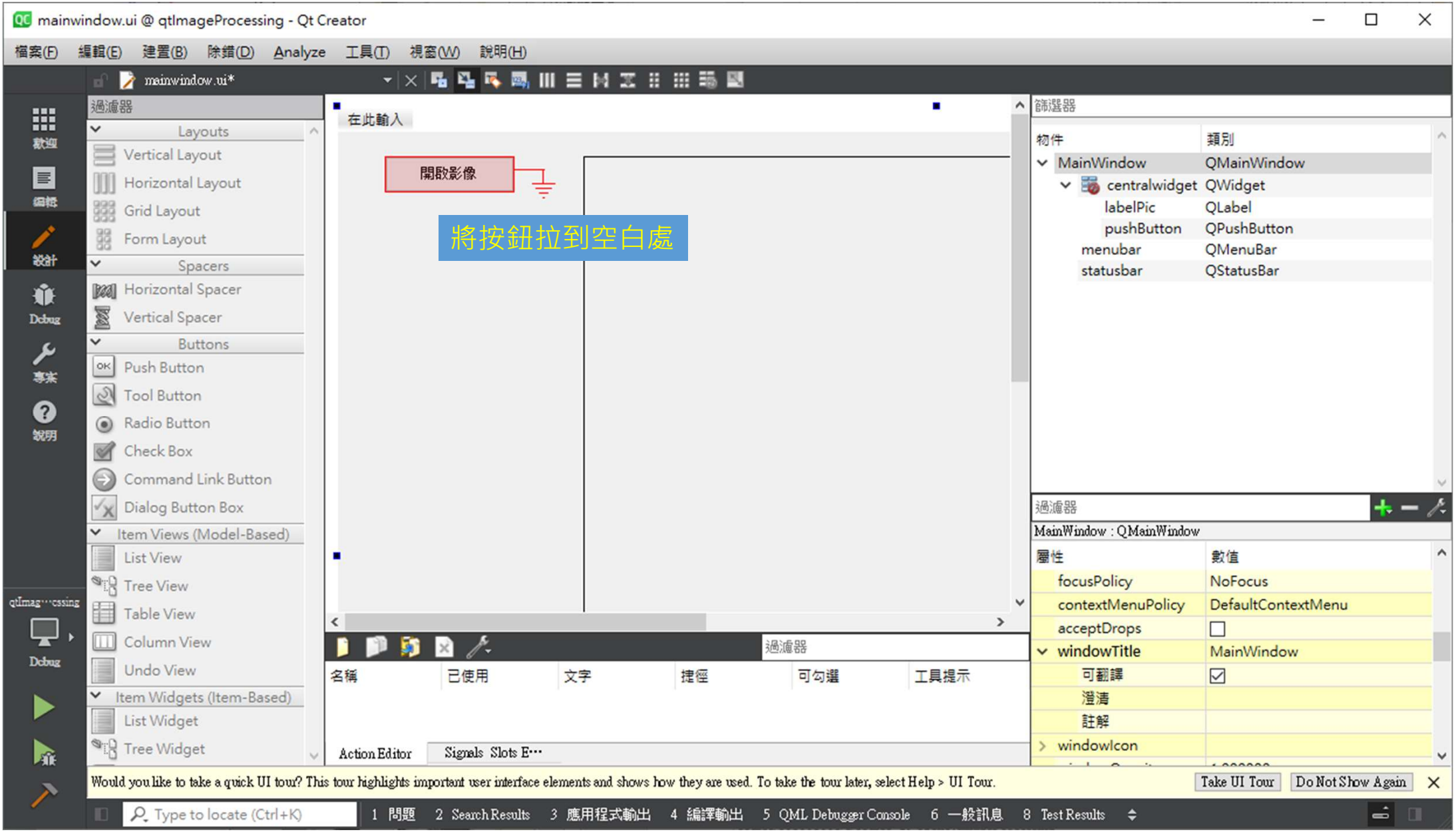
1 問題
2 Search Results
3 應用程式輸出
4 編譯輸出
5 QML Debugger Console
6 一般訊息
8 Test Results


mainwindow.ui @ qtImageProcessing - Qt Creator
檔案(F) 編輯(E) 建置(B) 除錯(D) Analyze 工具(T) 視窗(W) 說明(H)
mainwindow.ui*
過濾器
Layouts
Vertical Layout
Horizontal Layout
Grid Layout
Form Layout
Spacers
Horizontal Spacer
Vertical Spacer
Buttons
Push Button
Tool Button
Radio Button
Check Box
Command Link Button
Dialog Button Box
Item Views (Model-Based)
List View
Tree View
Table View
Column View
Undo View
Item Widgets (Item-Based)
List Widget
Tree Widget
在此輸入
開啟影像
將按鈕拉到空白處
過濾器
名稱 已使用 文字 捷徑 可勾選 工具提示
Action Editor
Signals Slots E…
篩選器
物件 類別
MainWindow QMainWindow
centralwidget QWidget
labelPic QLabel
pushButton QPushButton
menubar QMenuBar
statusbar QStatusBar
過濾器
MainWindow : QMainWindow
屬性 數值
focusPolicy NoFocus
contextMenuPolicy DefaultContextMenu
acceptDrops
windowTitle MainWindow
可翻譯
澄清
註解
windowIcon
歡迎
編輯
設計
Debug
專案
說明
Debug
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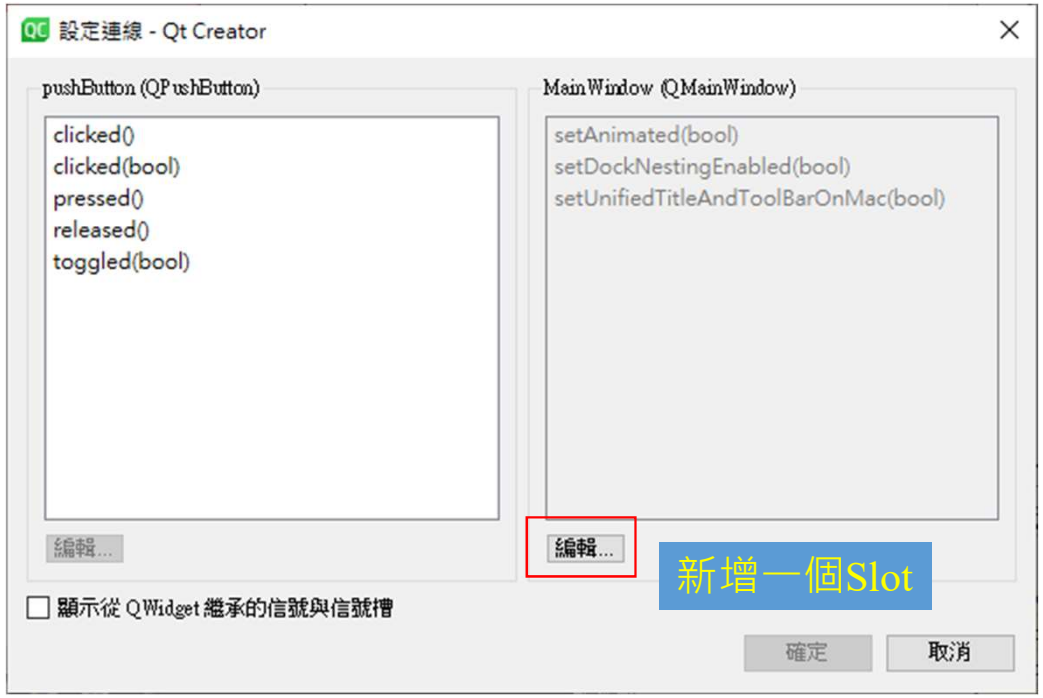
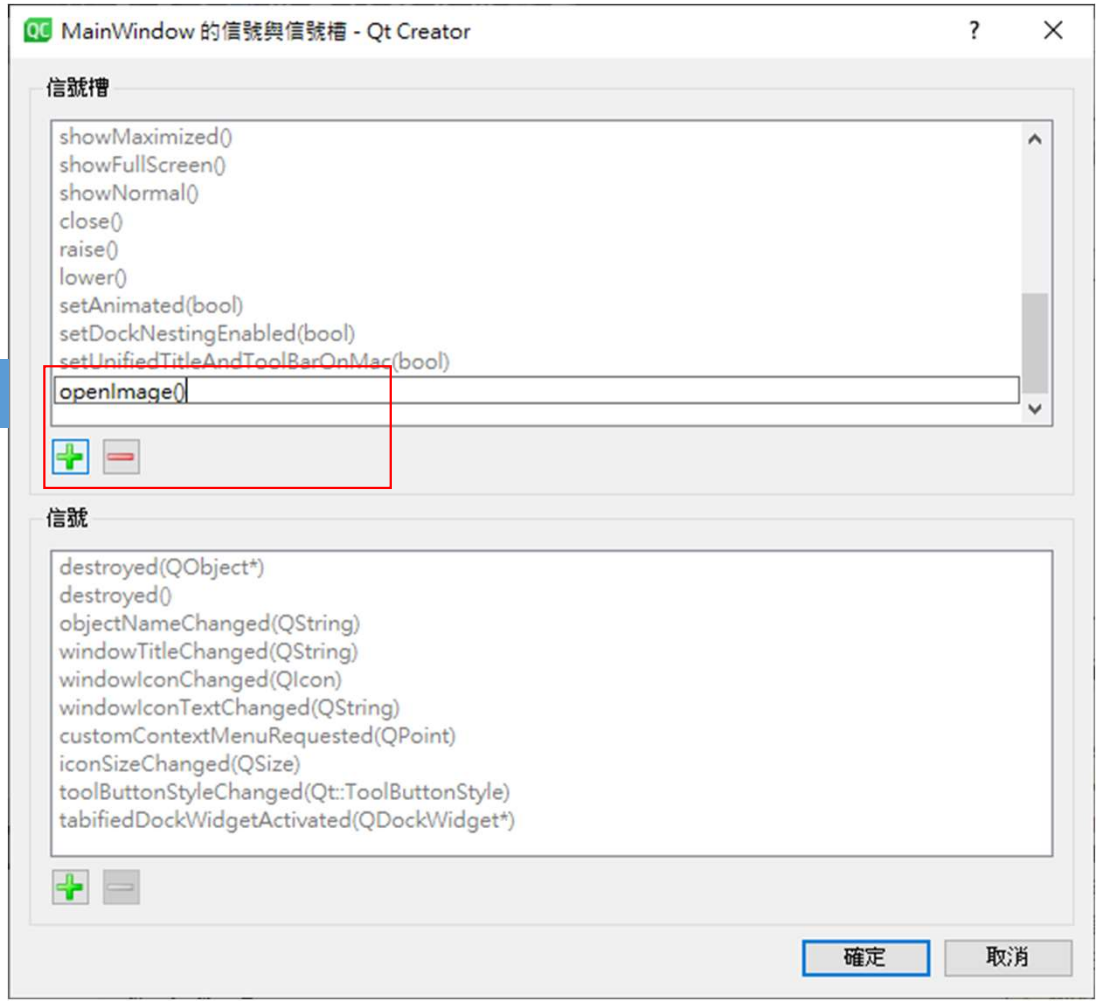
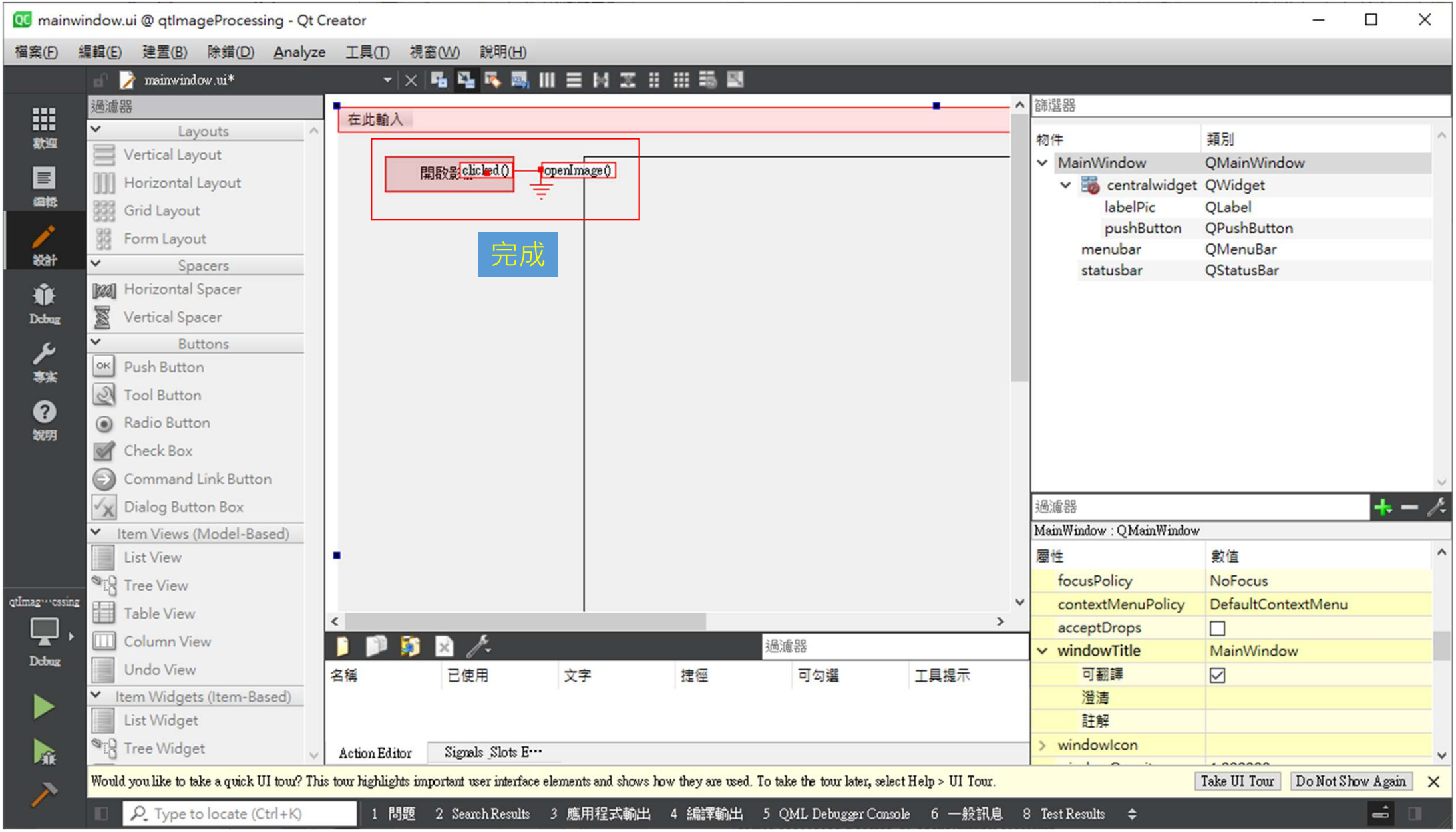

設定連線 - Qt Creator
pushButton (QPushButton)
clicked()
clicked(bool)
pressed()
released()
toggled(bool)
編輯...
MainWindow (QMainWindow)
setAnimated(bool)
setDockNestingEnabled(bool)
setUnifiedTitleAndToolBarOnMac(bool)
編輯...
新增一個Slot
顯示從 QWidget 繼承的信號與信號槽
確定
取消

新增一個 **openImage()**




mainwindow.ui @ qtImageProcessing - Qt Creator
檔案(F) 編輯(E) 建置(B) 除錯(D) Analyze 工具(T) 視窗(W) 說明(H)
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過濾器
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Command Link Button
Dialog Button Box
Item Views (Model-Based)
List View
Tree View
Table View
Column View
Undo View
Item Widgets (Item-Based)
List Widget
Tree Widget
在此輸入
開啟影...
clicked()
openImage()
完成
過濾器
名稱 已使用 文字 捷徑 可勾選 工具提示
Action Editor
Signals Slots E...
篩選器
物件 類別
MainWindow QMainWindow
centralwidget QWidget
labelPic QLabel
pushButton QPushButton
menubar QMenuBar
statusbar QStatusBar
過濾器
MainWindow : QMainWindow
屬性 數值
focusPolicy NoFocus
contextMenuPolicy DefaultContextMenu
acceptDrops
windowTitle MainWindow
可翻譯
澄清
註解
windowIcon
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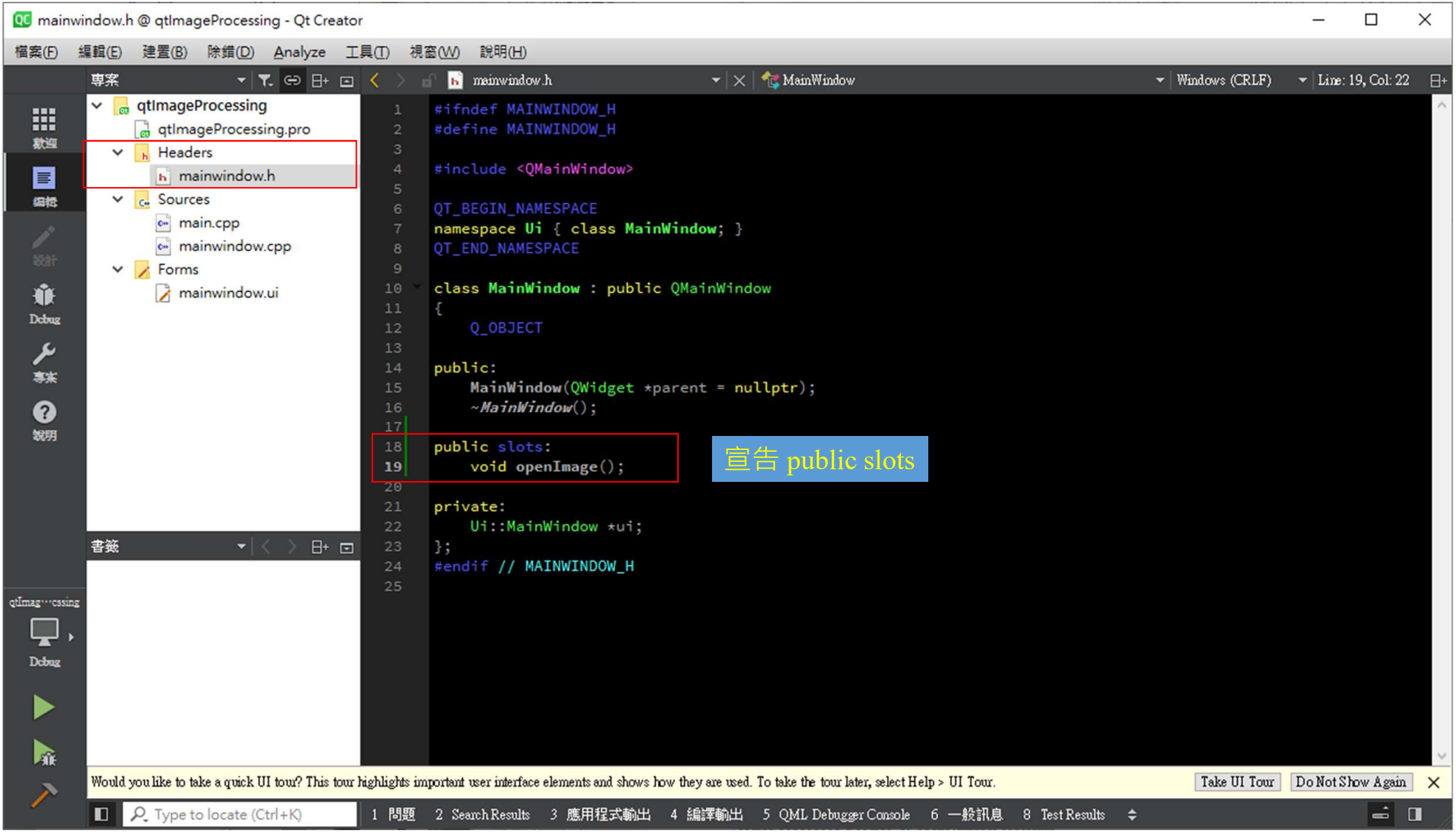
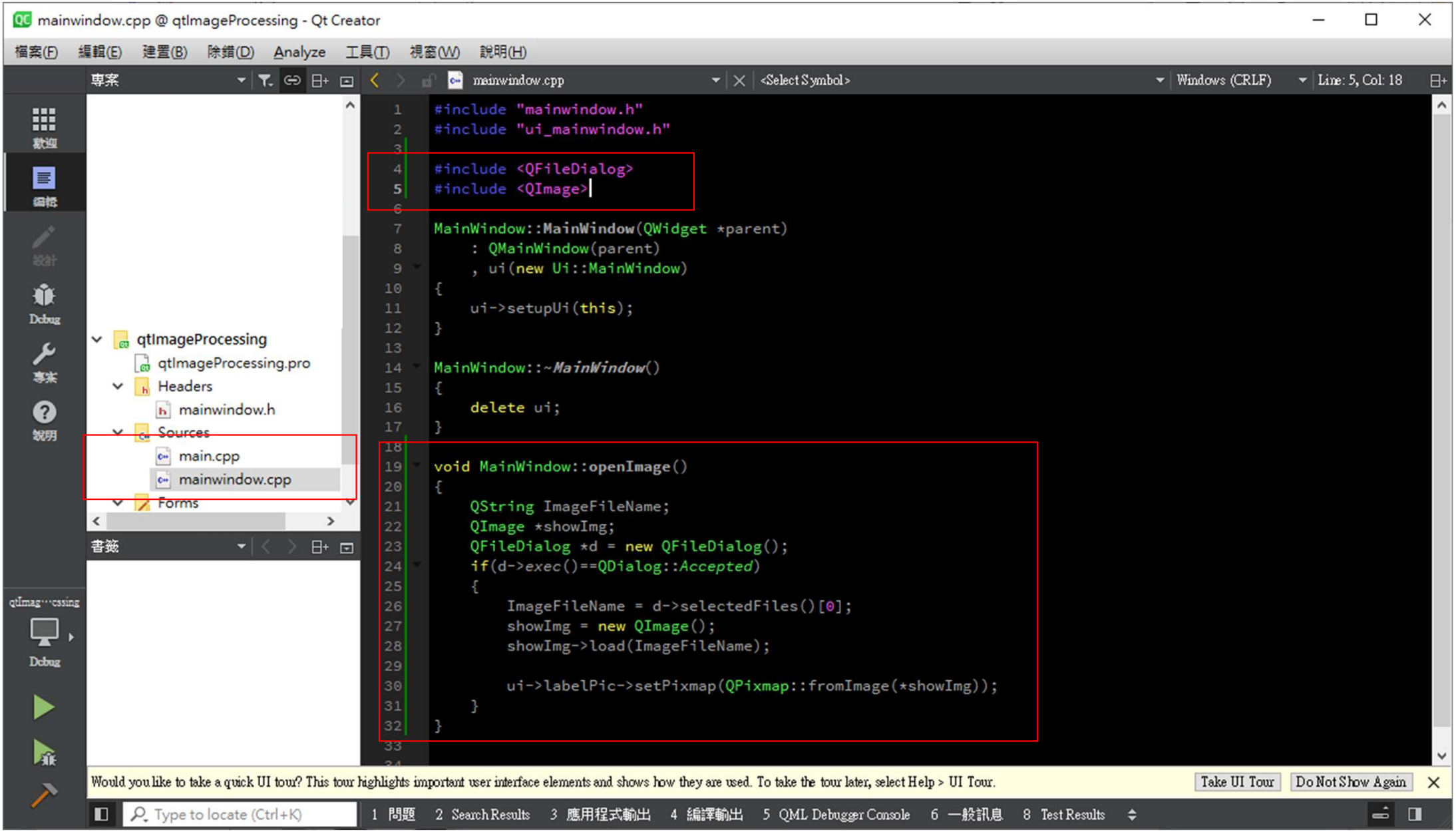
設計
Debug
專案
說明
Debug


mainwindow.h @ qtImageProcessing - Qt Creator
檔案(F) 編輯(E) 建置(B) 除錯(D) Analyze 工具(T) 視窗(W) 說明(H)
專案
qtImageProcessing
qtImageProcessing.pro
Headers
mainwindow.h
Sources
main.cpp
mainwindow.cpp
Forms
mainwindow.ui
書籤
mainwindow.h
MainWindow
Windows (CRLF)
Line: 19, Col: 22
#ifndef MAINWINDOW_H
#define MAINWINDOW_H
#include <QMainWindow>
QT_BEGIN_NAMESPACE
namespace Ui { class MainWindow; }
QT_END_NAMESPACE
class MainWindow : public QMainWindow
{
Q_OBJECT
public:
MainWindow(QWidget *parent = nullptr);
~MainWindow();
public slots:
void openImage();
private:
Ui::MainWindow *ui;
};
#endif // MAINWINDOW_H
宣告 public slots
歡迎
編輯
設計
Debug
專案
說明
Debug
Would you like to take a quick UI tour? This tour highlights important user interface elements and shows how they are used. To take the tour later, select Help > UI Tour.
Take UI Tour
Do Not Show Again
Type to locate (Ctrl+K)
1 問題
2 Search Results
3 應用程式輸出
4 編譯輸出
5 QML Debugger Console
6 一般訊息
8 Test Results


mainwindow.cpp @ qtImageProcessing - Qt Creator
檔案(F) 編輯(E) 建置(B) 除錯(D) Analyze 工具(T) 視窗(W) 說明(H)
專案
mainwindow.cpp
<Select Symbol>
Windows (CRLF)
Line: 5, Col: 18
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書籤
#include "mainwindow.h"
#include "ui_mainwindow.h"
#include <QFileDialog>
#include <QImage>
MainWindow::MainWindow(QWidget *parent)
: QMainWindow(parent)
, ui(new Ui::MainWindow)
{
ui->setupUi(this);
}
MainWindow::~MainWindow()
{
delete ui;
}
void MainWindow::openImage()
{
QString ImageFileName;
QImage *showImg;
QFileDialog *d = new QFileDialog();
if(d->exec()==QDialog::Accepted)
{
ImageFileName = d->selectedFiles()[0];
showImg = new QImage();
showImg->load(ImageFileName);
ui->labelPic->setPixmap(QPixmap::fromImage(*showImg));
}
}
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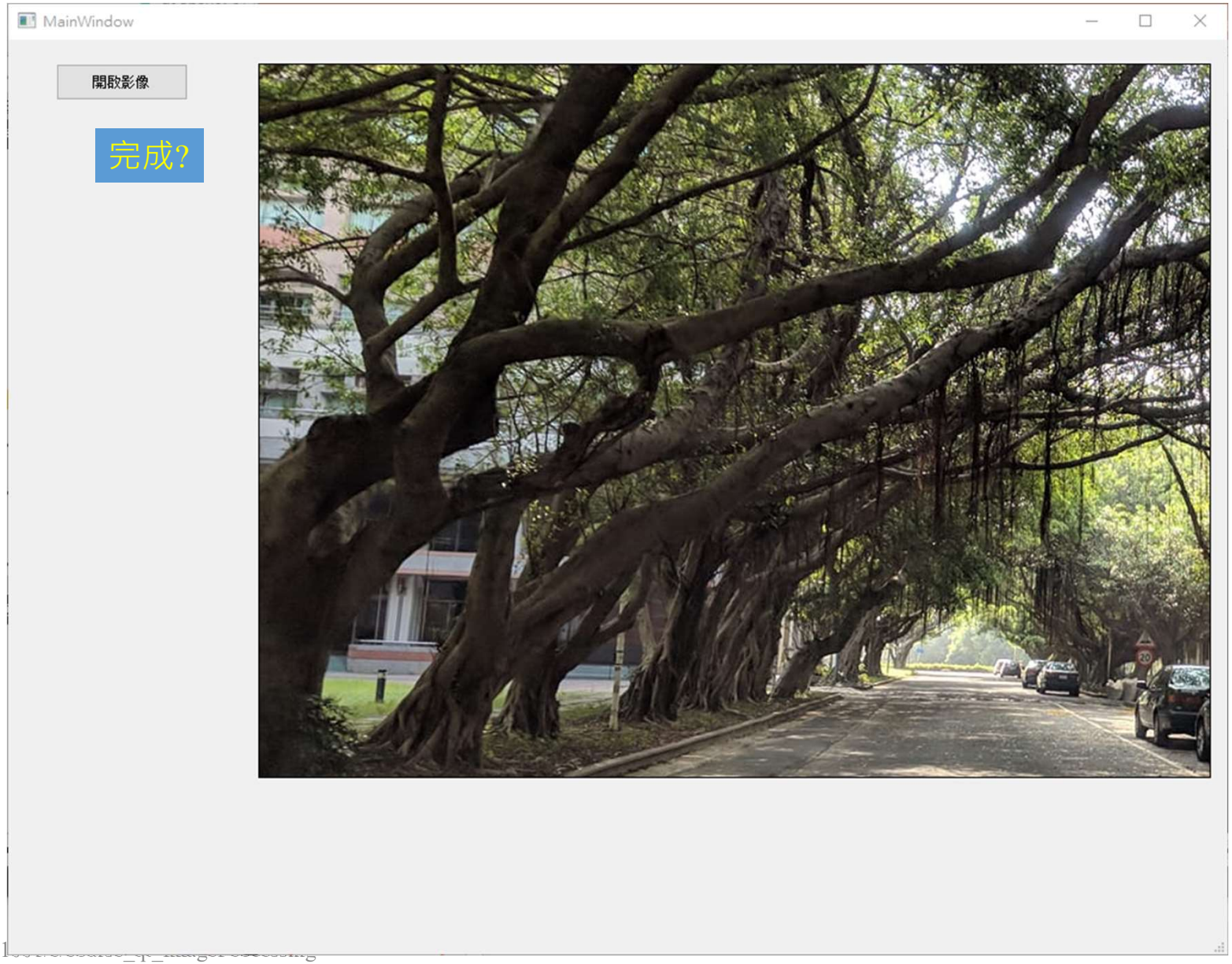
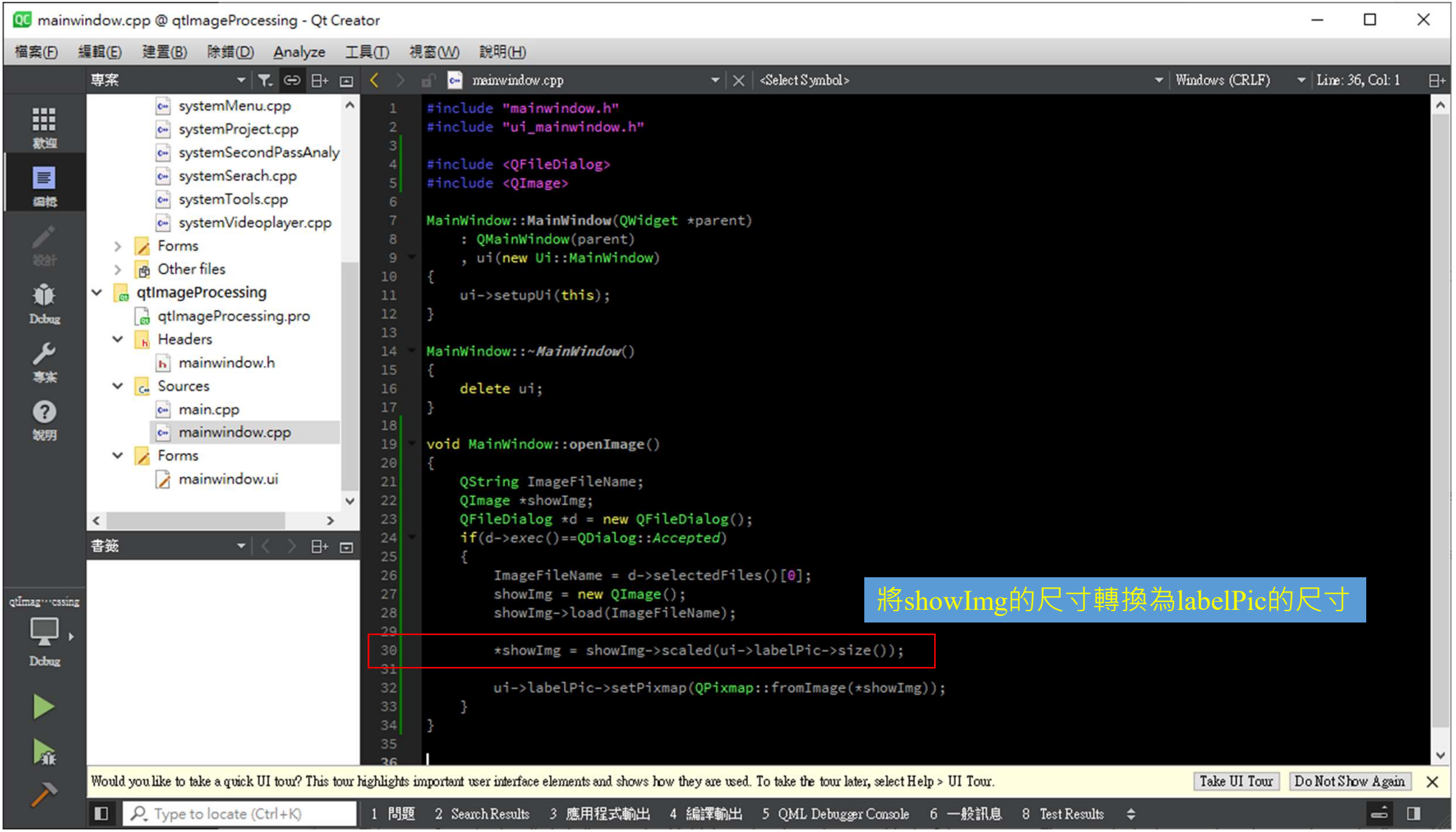
```
#include <QFileDialog>
#include <QImage>
```

```
void MainWindow::openImage()
{
    QString ImageFileName;
    QImage *showImg;
    QFileDialog *d = new QFileDialog();
    if(d->exec()==QDialog::Accepted)
    {
        ImageFileName = d->selectedFiles()[0];
        showImg = new QImage();
        showImg->load(ImageFileName);

        ui->labelPic->setPixmap(QPixmap::fromImage(*showImg));
    }
}
```


MainWindow
開啟影像
完成?

好像少了些什麼


mainwindow.cpp @ qtImageProcessing - Qt Creator
檔案(F) 編輯(E) 建置(B) 除錯(D) Analyze 工具(T) 視窗(W) 說明(H)
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歡迎
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說明
Debug
mainwindow.cpp
<Select Symbol>
Windows (CRLF)
Line: 36, Col: 1
#include "mainwindow.h"
#include "ui_mainwindow.h"
#include <QFileDialog>
#include <QImage>
MainWindow::MainWindow(QWidget *parent)
: QMainWindow(parent)
, ui(new Ui::MainWindow)
{
ui->setupUi(this);
}
MainWindow::~MainWindow()
{
delete ui;
}
void MainWindow::openImage()
{
QString ImageFileName;
QImage *showImg;
QFileDialog *d = new QFileDialog();
if(d->exec()==QDialog::Accepted)
{
ImageFileName = d->selectedFiles()[0];
showImg = new QImage();
showImg->load(ImageFileName);
*showImg = showImg->scaled(ui->labelPic->size());
ui->labelPic->setPixmap(QPixmap::fromImage(*showImg));
}
}
將showImg的尺寸轉換為labelPic的尺寸
Would you like to take a quick UI tour? This tour highlights important user interface elements and shows how they are used. To take the tour later, select Help > UI Tour.
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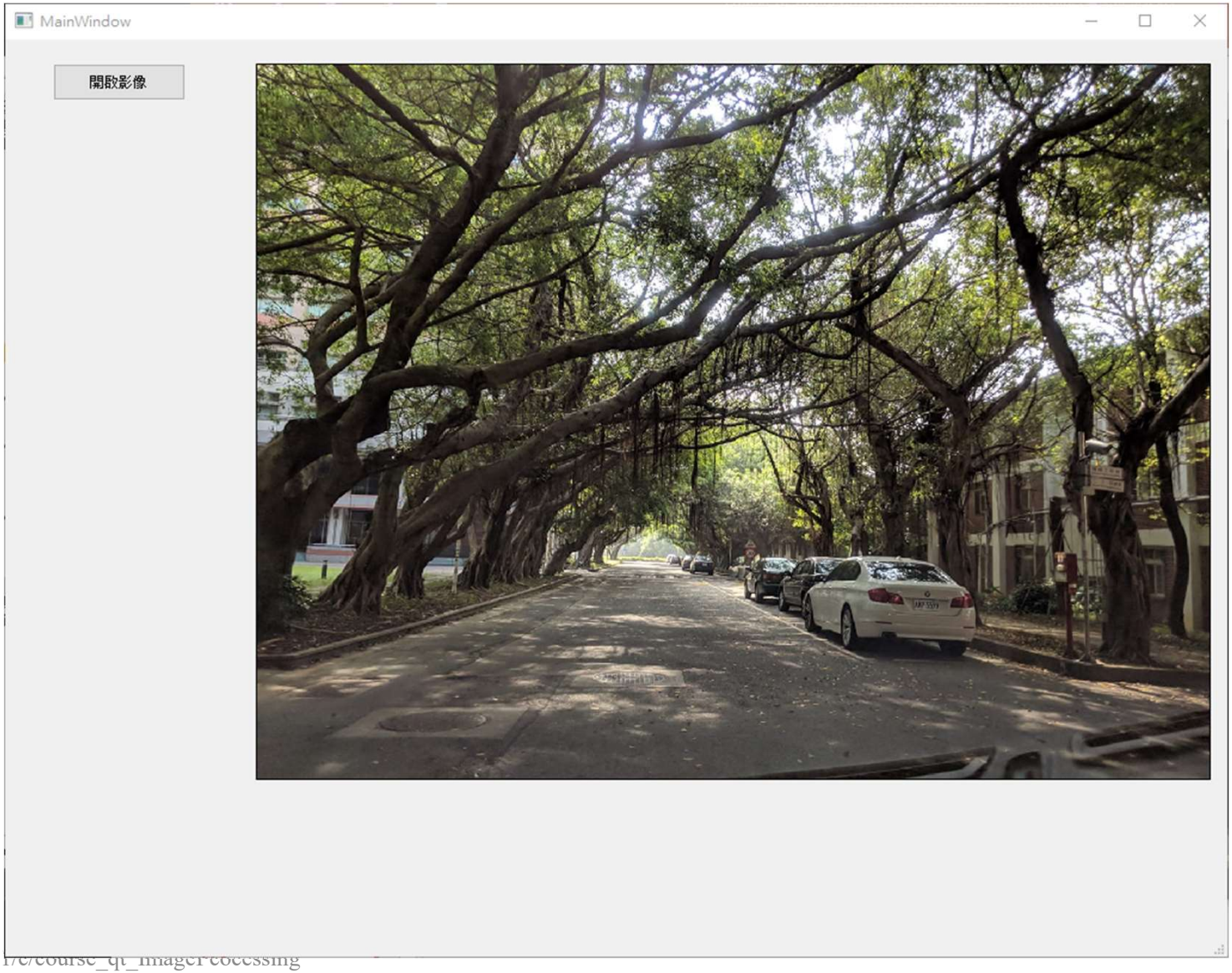
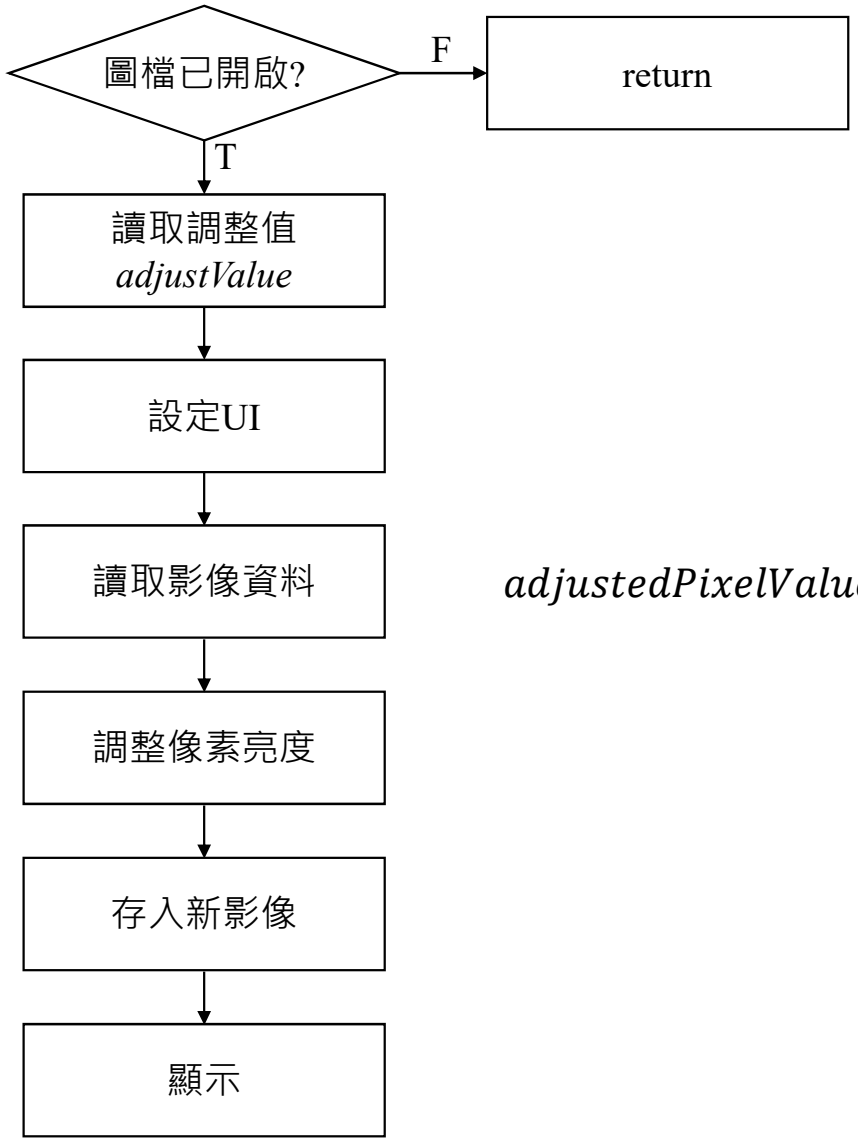

MainWindow
開啟影像

調整影像亮度(by Pixel)

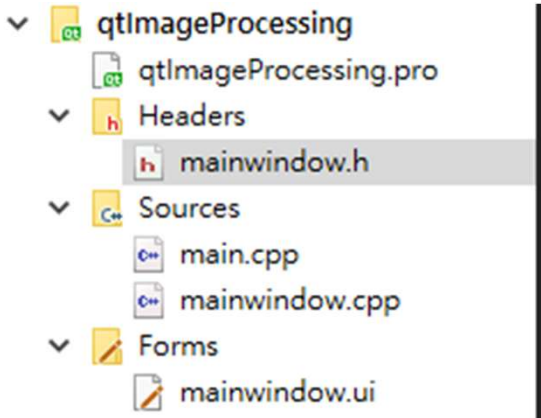


$$adjustedPixelValue = orginalPixelValue \times \left(1 + \frac{adjustValue}{100}\right)$$

開始之前—調整變數的視野(Scope)

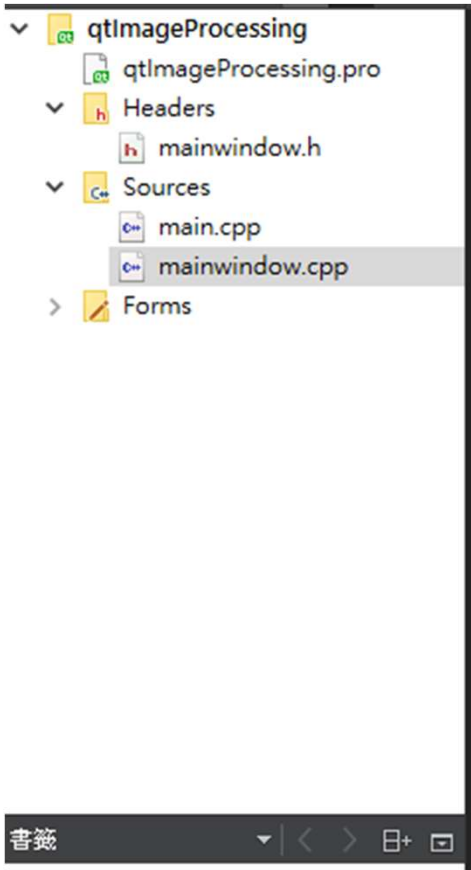
```
19  void MainWindow::openImage()
20  {
21      QString ImageFileName;
22      QImage *showImg;
23      QFileDialog *d = new QFileDialog();
24      if(d->exec()==QDialog::Accepted)
25      {
26          ImageFileName = d->selectedFiles()[0];
27          showImg = new QImage();
28          showImg->load(ImageFileName);
29
30          *showImg = showImg->scaled(ui->labelPic->size());
31
32          ui->labelPic->setPixmap(QPixmap::fromImage(*showImg));
33      }
34  }
```

改成全域變數




```h
#ifndef MAINWINDOW_H
#define MAINWINDOW_H

#include <QMainWindow>

QT_BEGIN_NAMESPACE
namespace Ui { class MainWindow; }
QT_END_NAMESPACE

class MainWindow : public QMainWindow
{
    Q_OBJECT

public:
    MainWindow(QWidget *parent = nullptr);
    ~MainWindow();

    QImage *orgImg;
    QImage *showImg;
    QImage *adjustedImg;
    bool imageOpened;

public slots:
    void openImage();

private:
    Ui::MainWindow *ui;
};
#endif // MAINWINDOW_H
```

宣告全域變數
併加上控制變數

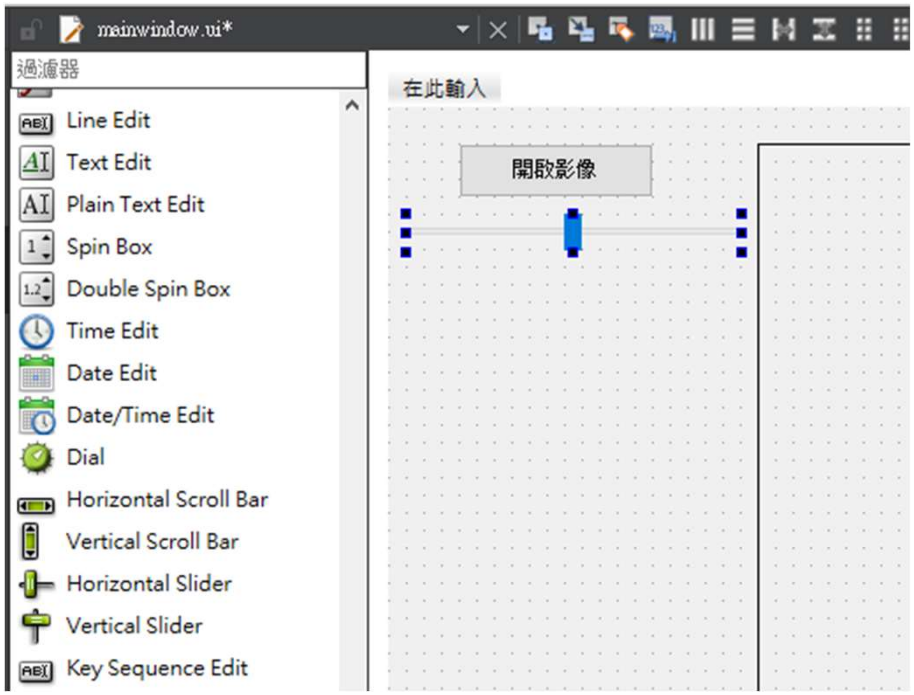



```cpp
#include "mainwindow.h"
#include "ui_mainwindow.h"

#include <QFileDialog>
#include <QImage>

MainWindow::MainWindow(QWidget *parent)
    : QMainWindow(parent)
    , ui(new Ui::MainWindow)
{
    ui->setupUi(this);

    imageOpened = false;
}

MainWindow::~MainWindow()
{
    delete ui;
}

void MainWindow::openImage()
{
    QString ImageFileName;
    QFileDialog *d = new QFileDialog();
    if(d->exec()==QDialog::Accepted)
    {
        ImageFileName = d->selectedFiles()[0];
        showImg = new QImage();
        showImg->load(ImageFileName);

        *showImg = showImg->scaled(ui->labelPic->size());

        ui->labelPic->setPixmap(QPixmap::fromImage(*showImg));

        imageOpened = true;
    }
}
```

程式開始時的預設值

圖檔開啟後的控制項

```cpp
void MainWindow::openImage()
{
    QString ImageFileName;
    QFileDialog *d = new QFileDialog();
    if(d->exec()==QDialog::Accepted)
    {
        ImageFileName = d->selectedFiles()[0];
        orgImg = new QImage();
        orgImg->load(ImageFileName);
        adjustedImg = new QImage(orgImg->width(),orgImg->height(),orgImg->format());
        showImg = new QImage(*orgImg);

        *showImg = showImg->scaled(ui->labelPic->size());
        ui->labelPic->setPixmap(QPixmap::fromImage(*showImg));
        ui->labelBrightAdjustValue->setText("0");
        ui->sliderImageBrightness->setSliderPosition(0);

        imageOpened = true;
    }
}
```

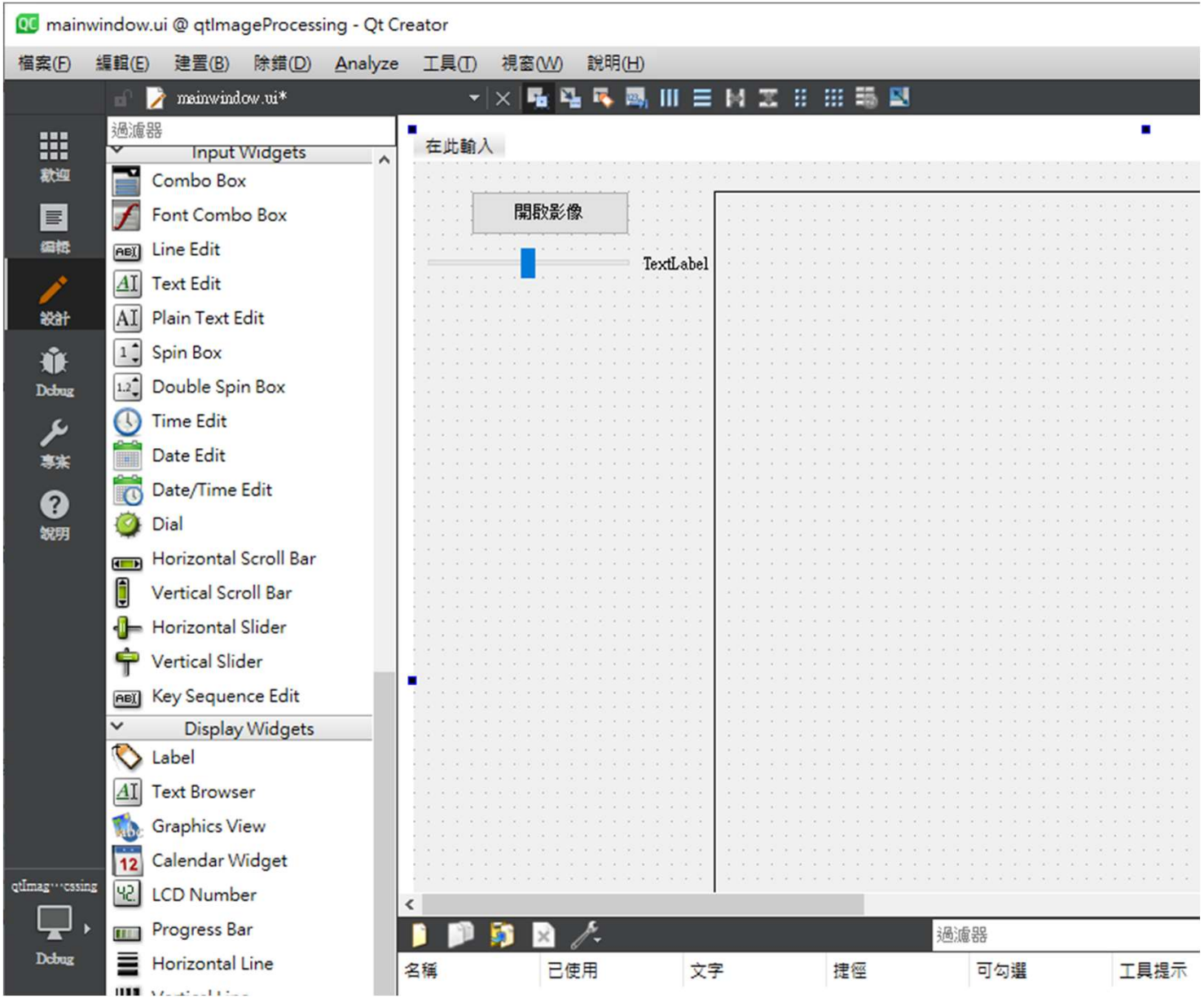


屬性	數值
QObject	
objectName	sliderImageBrightness
QWidget	
enabled	☑
geometry	[(10, 60), 191x22]
X	10
Y	60
寬度	191
高度	22
sizePolicy	[Expanding, Fixed, 0, 0]

sliderImageBrightness : QSlider

屬性	數值
locale	Chinese，Taiwan
inputMethodHints	ImhNone
QAbstractSlider	
minimum	-100
maximum	100
singleStep	1
pageStep	10
value	0
sliderPosition	0
tracking	☑

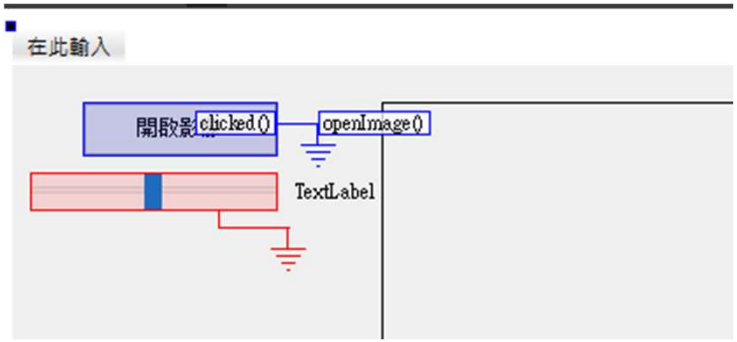
minimum: -100
maximum: 100
singleStep: 1
value: 0

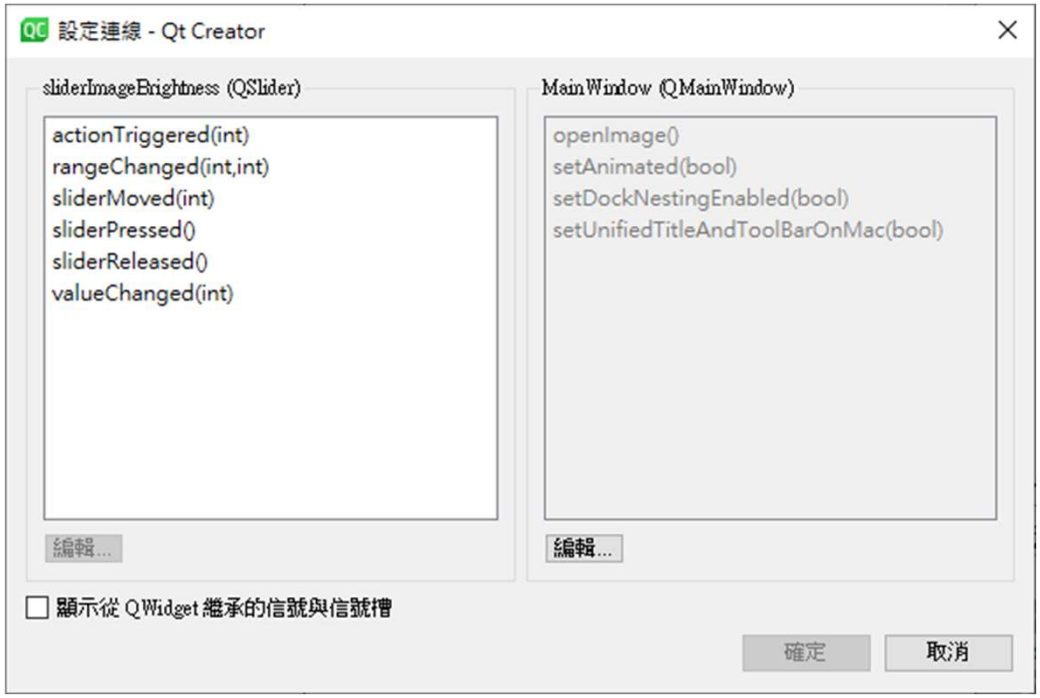


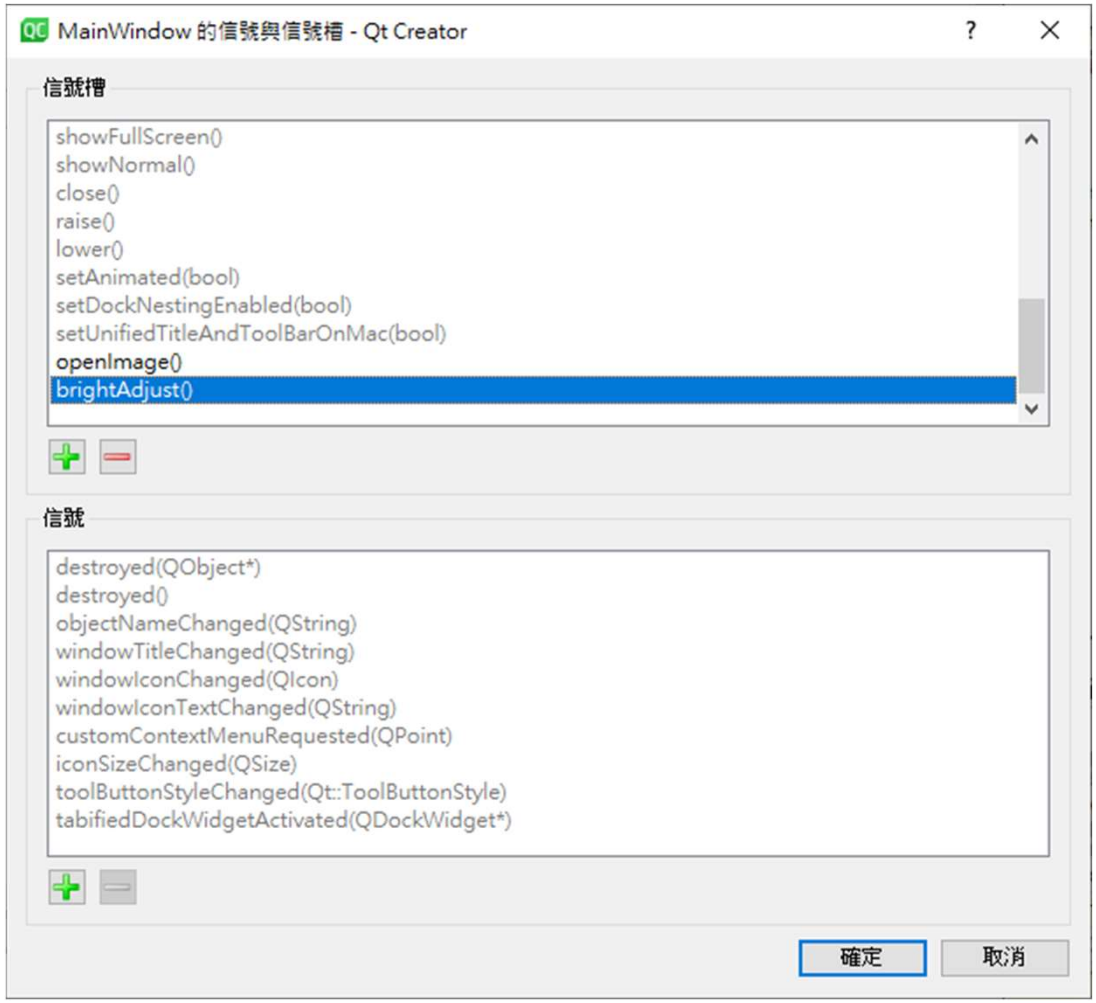
objectName: labelBrightAdjustValue

labelBrightAdjustValue : QLabel

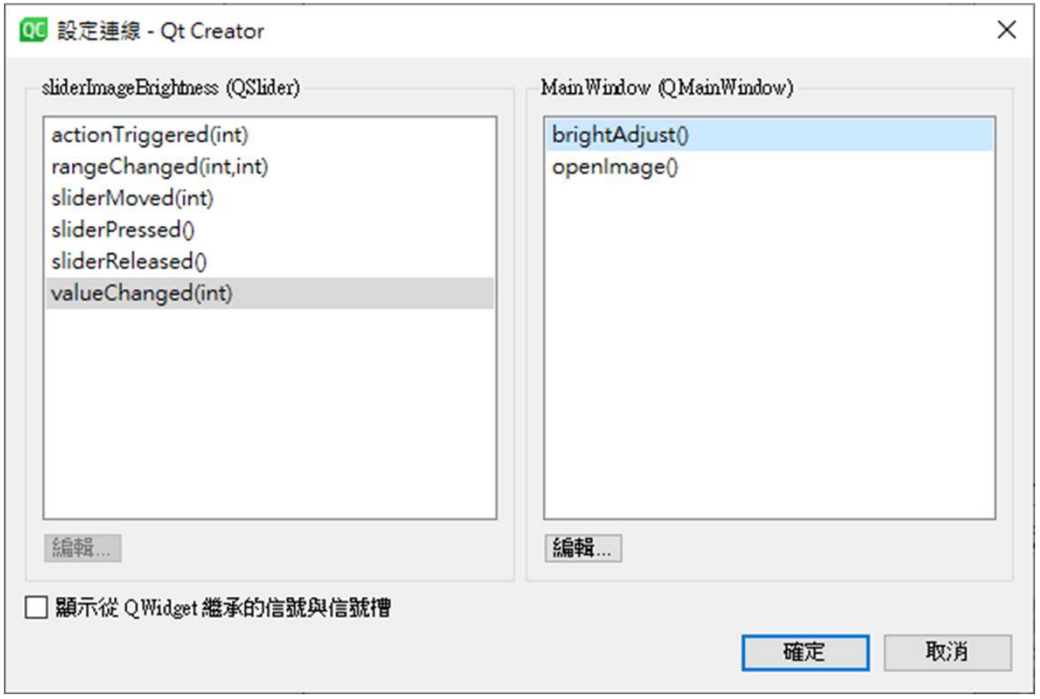
屬性	數值
QObject	
objectName	labelBrightAdjustValue
QWidget	
enabled	☑
geometry	[(160, 61), 47x21]
X	160
Y	61
寬度	47
高度	21
sizePolicy	[Preferred, Preferred, 0, 0]

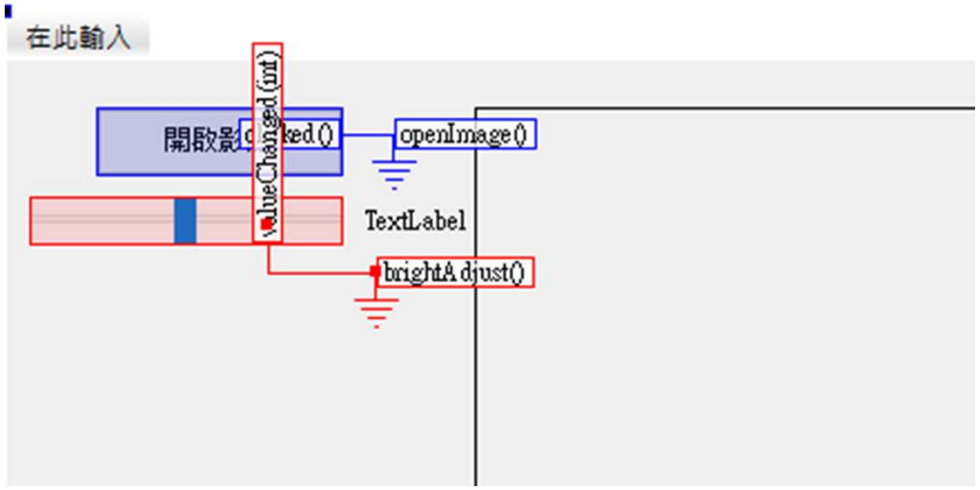

在此輸入
開啟影
clicked()
openImage()
TextLabel

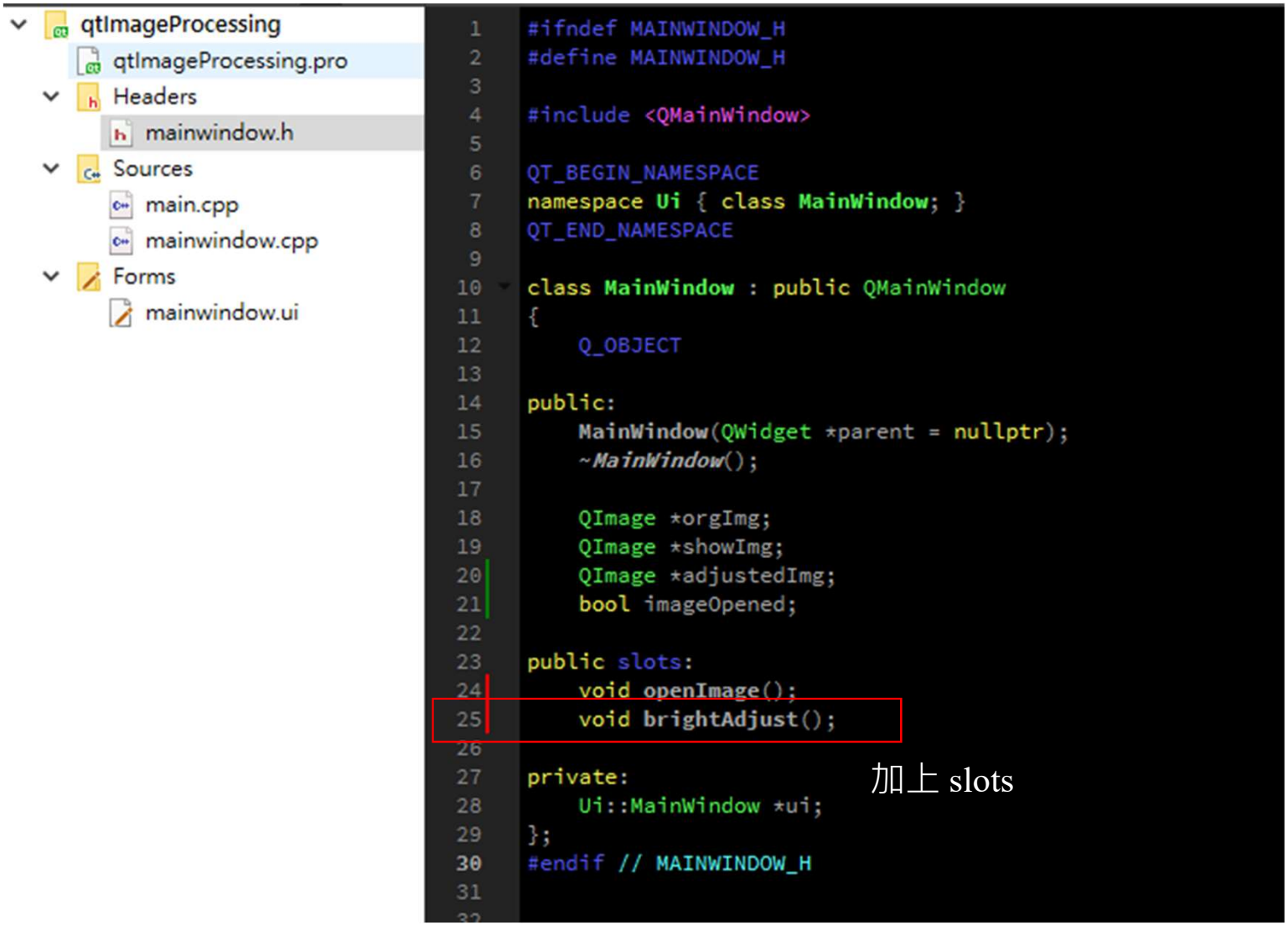

設定連線 - Qt Creator
sliderImageBrightness (QSlider)
actionTriggered(int)
rangeChanged(int,int)
sliderMoved(int)
sliderPressed()
sliderReleased()
valueChanged(int)
編輯...
MainWindow (QMainWindow)
openImage()
setAnimated(bool)
setDockNestingEnabled(bool)
setUnifiedTitleAndToolBarOnMac(bool)
編輯...
顯示從 QWidget 繼承的信號與信號槽
確定
取消



/course/101001001/c/course_qt_ImagePcocessing


設定連線 - Qt Creator
sliderImageBrightness (QSlider)
actionTriggered(int)
rangeChanged(int,int)
sliderMoved(int)
sliderPressed()
sliderReleased()
valueChanged(int)
編輯...
MainWindow (QMainWindow)
brightAdjust()
openImage()
編輯...
顯示從 QWidget 繼承的信號與信號槽
確定
取消


在此輸入
valueChanged(int)
openImage()
TextLabel
brightAdjust()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qtImageProcessing.pro
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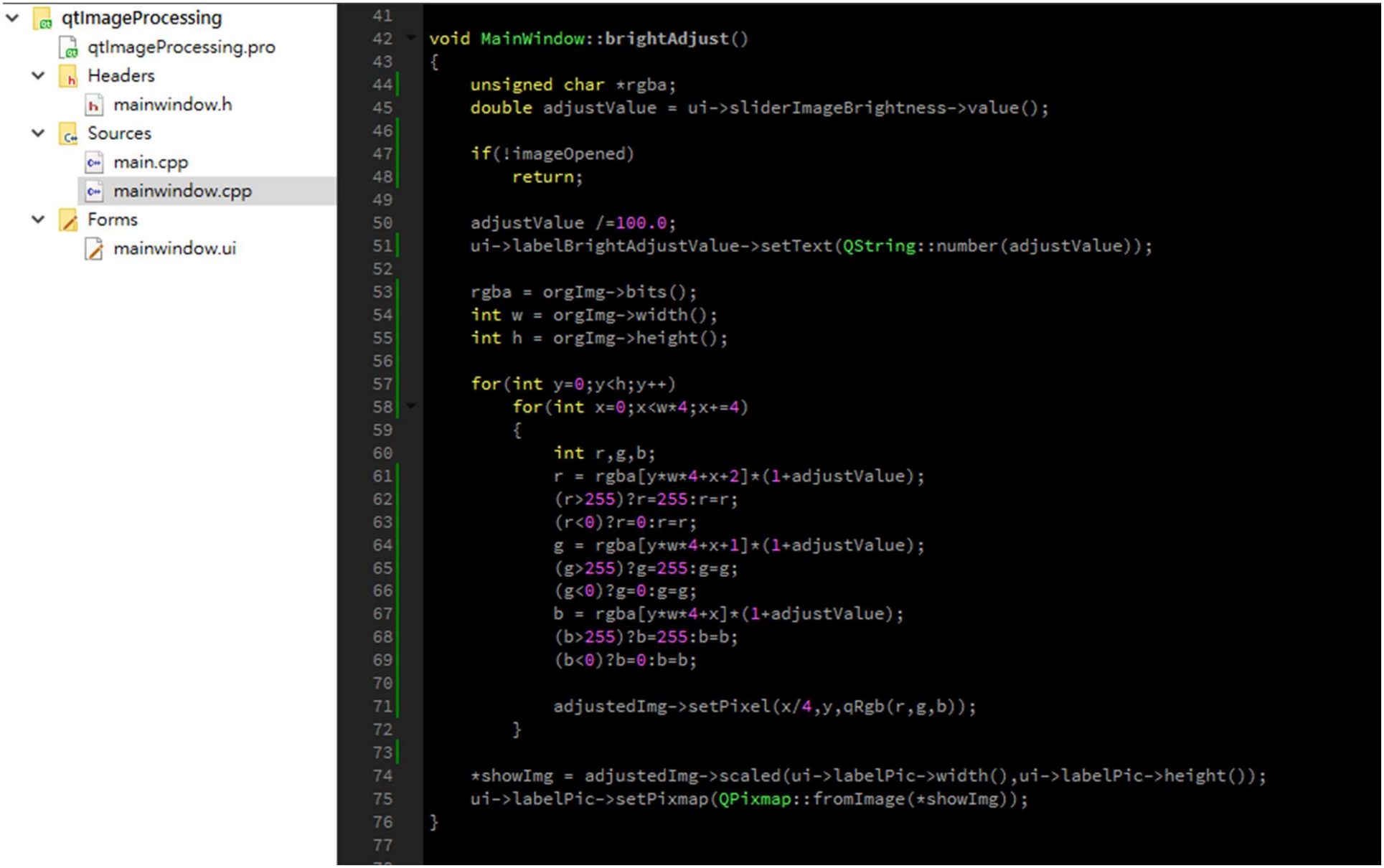
#define MAINWINDOW_H
#include <QMainWindow>
QT_BEGIN_NAMESPACE
namespace Ui { class MainWindow; }
QT_END_NAMESPACE
class MainWindow : public QMainWindow
{
Q_OBJECT
public:
MainWindow(QWidget *parent = nullptr);
~MainWindow();
QImage *orgImg;
QImage *showImg;
QImage *adjustedImg;
bool imageOpened;
public slots:
void openImage();
void brightAdjust();
private:
Ui::MainWindow *ui;
};
#endif // MAINWINDOW_H
加上 slots




```
41
42  void MainWindow::brightAdjust()
43  {
44      unsigned char *rgba;
45      double adjustValue = ui->sliderImageBrightness->value();
46
47      if(!imageOpened)
48          return;
49
50      adjustValue /=100.0;
51      ui->labelBrightAdjustValue->setText(QString::number(adjustValue));
52
53      rgba = orgImg->bits();
54      int w = orgImg->width();
55      int h = orgImg->height();
56
57      for(int y=0;y<h;y++)
58          for(int x=0;x<w*4;x+=4)
59          {
60              int r,g,b;
61              r = rgba[y*w*4+x+2]*(1+adjustValue);
62              (r>255)?r=255:r=r;
63              (r<0)?r=0:r=r;
64              g = rgba[y*w*4+x+1]*(1+adjustValue);
65              (g>255)?g=255:g=g;
66              (g<0)?g=0:g=g;
67              b = rgba[y*w*4+x]*(1+adjustValue);
68              (b>255)?b=255:b=b;
69              (b<0)?b=0:b=b;
70
71              adjustedImg->setPixel(x/4,y,qRgb(r,g,b));
72          }
73
74      *showImg = adjustedImg->scaled(ui->labelPic->width(),ui->labelPic->height());
75      ui->labelPic->setPixmap(QPixmap::fromImage(*showImg));
76  }
77
```

```
44      unsigned char *rgba;
45      double adjustValue = ui->sliderImageBrightness->value();
```

宣告 unsigned char *rgba 為像素資料的指標
宣告 double adjustValue 為亮度調整值 → 數值會介於 -100 ~ +100 之間(原始值為整數)

```
47      if(!imageOpened)
48          return;
```

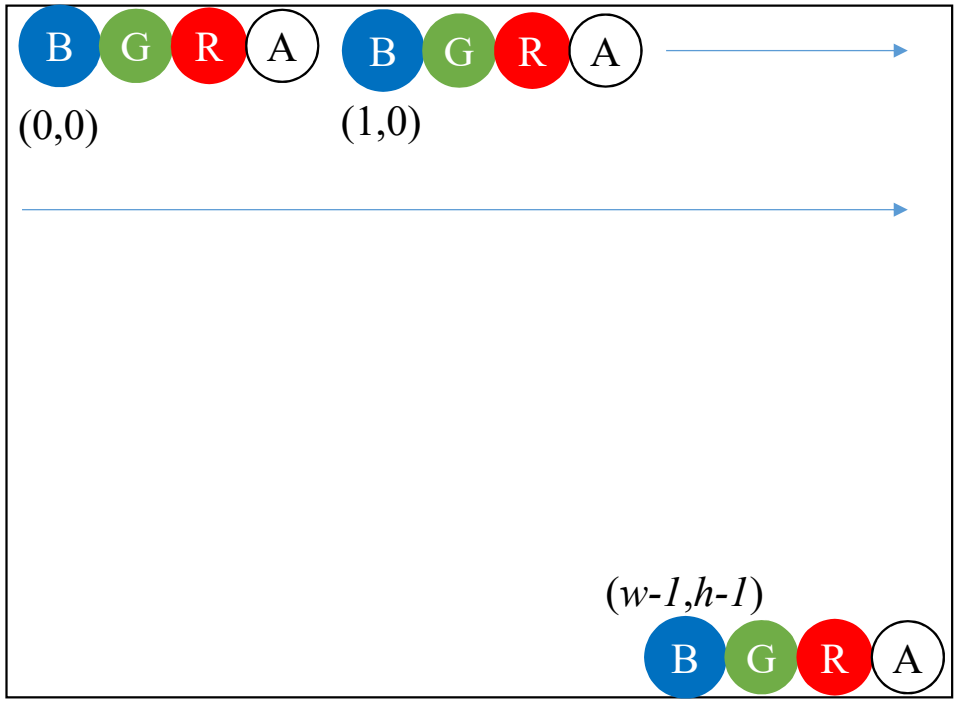
檢查影像是否開啟，沒有開啟的話就return

```
50      adjustValue /=100.0;
51      ui->labelBrightAdjustValue->setText(QString::number(adjustValue));
```

正規化調整值，使其介於-1~+1之間 (浮點數)
設定UI

```
53      rgba = orgImg->bits();
54      int w = orgImg->width();
55      int h = orgImg->height();
```

將 rgba 指向原始影像的資料位址，並將寬與高宣告成為變數


B G R A
B G R A
(0,0)
(1,0)
(w-1,h-1)
B G R A


B G R A
B G R A
B G R A
B G R A
[0] [1] [2] [3]
[4] [5] [6] [7]
[y*(w*4)+x]

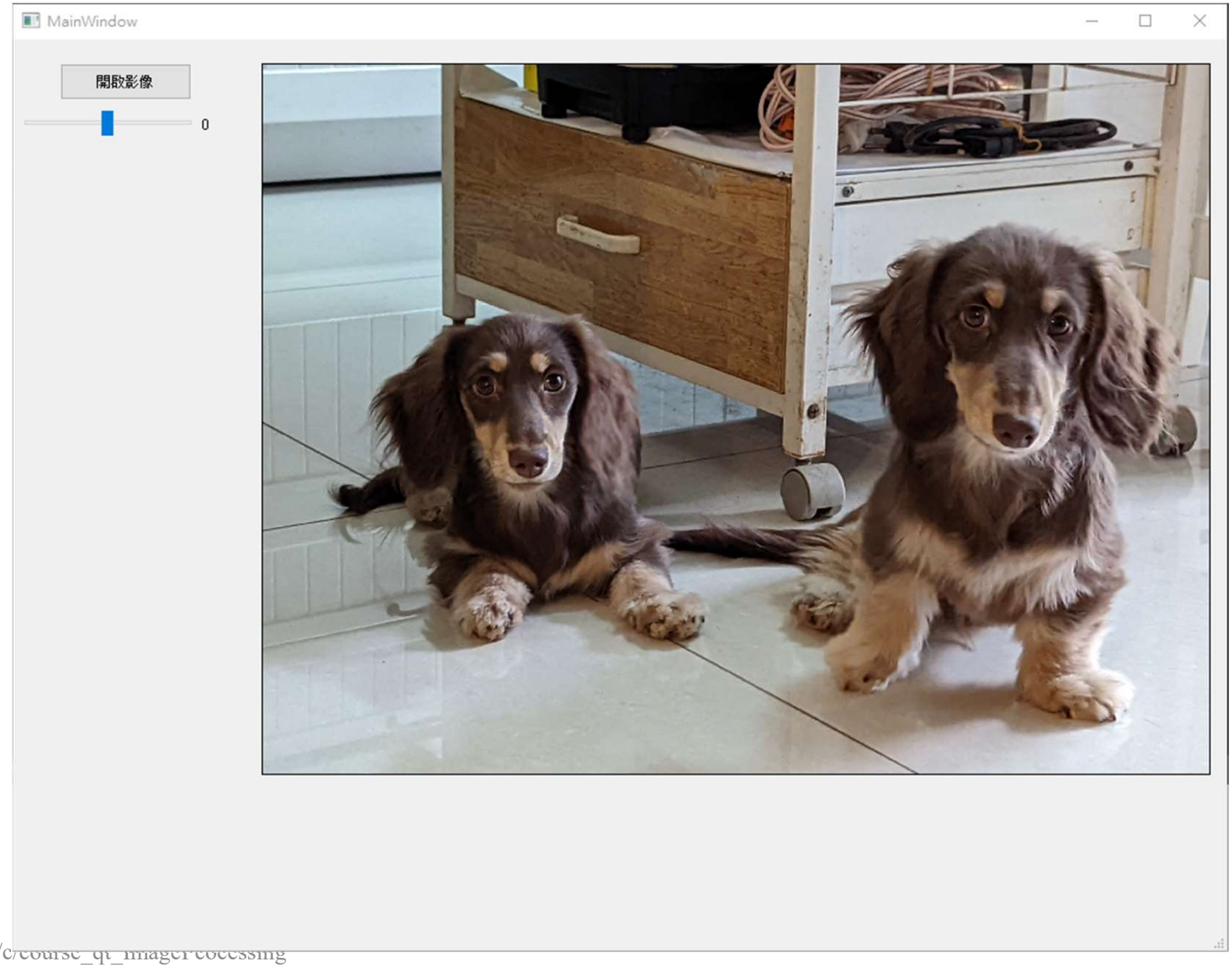
```
57      for(int y=0;y<h;y++)
58          for(int x=0;x<w*4;x+=4)
59          {
60              int r,g,b;
61              r = rgba[y*w*4+x+2]*(1+adjustValue);
62              (r>255)?r=255:r=r;
63              (r<0)?r=0:r=r;
64              g = rgba[y*w*4+x+1]*(1+adjustValue);
65              (g>255)?g=255:g=g;
66              (g<0)?g=0:g=g;
67              b = rgba[y*w*4+x]*(1+adjustValue);
68              (b>255)?b=255:b=b;
69              (b<0)?b=0:b=b;
70
71              adjustedImg->setPixel(x/4,y,qRgb(r,g,b));
72          }
```

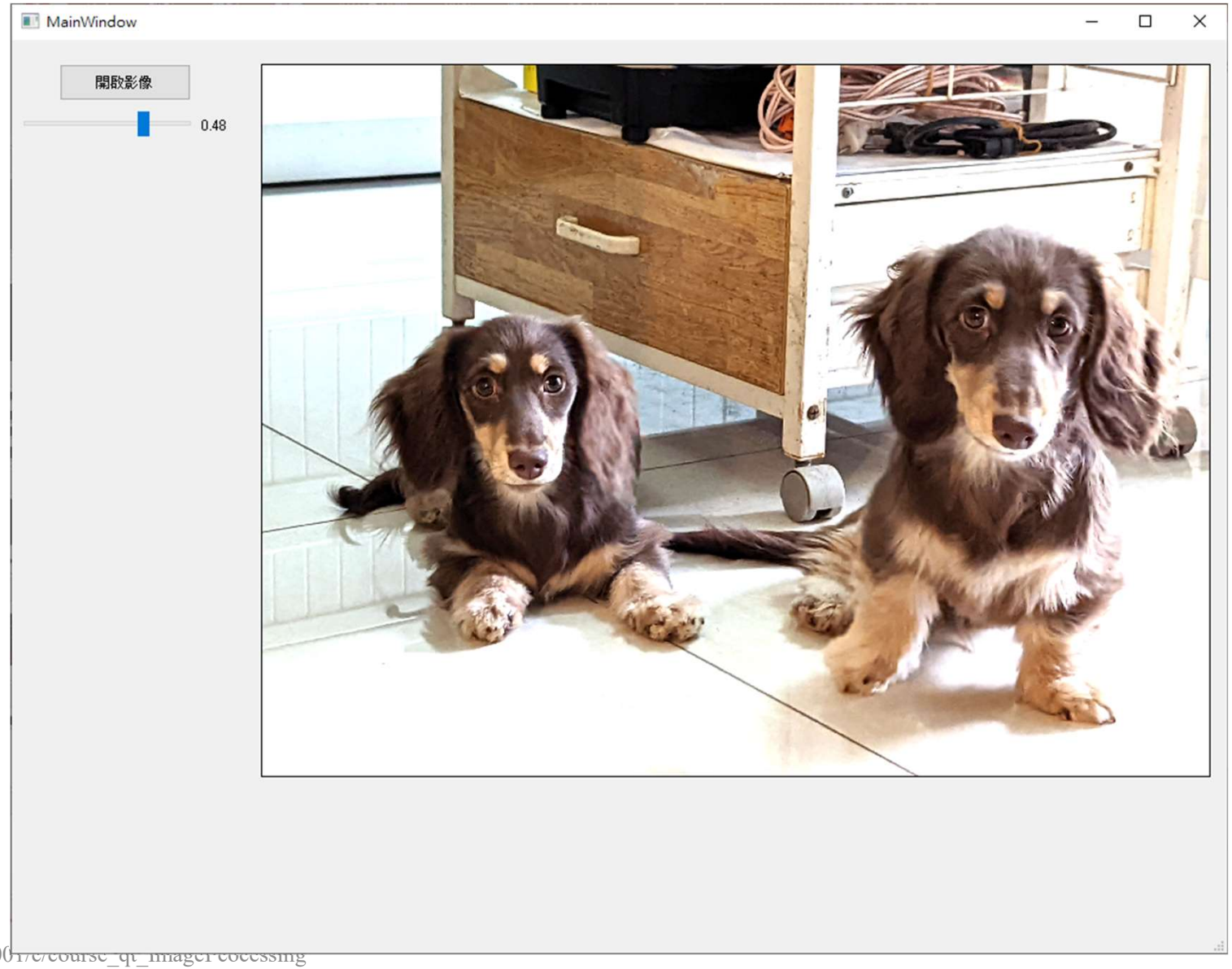
找到像素值並乘以調整值
同時限制像素介於0-255之間

將處理後的像素值透過qRgb()函數存到新的影像當中

```
74      *showImg = adjustedImg->scaled(ui->labelPic->width(),ui->labelPic->height());
75      ui->labelPic->setPixmap(QPixmap::fromImage(*showImg));
```

處理後的影像調整解析度後顯示到畫面上


MainWindow
開啟影像
0


MainWindow
開啟影像
0.48