

CVVisual

Ein Debug-Framework für OpenCV

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Gliederung

- Einführung in OpenCV
- Motivation
- Anwenderfeatures
- Gui-Demo
- Dokumentation
- Architektur
- API
- Ausblick

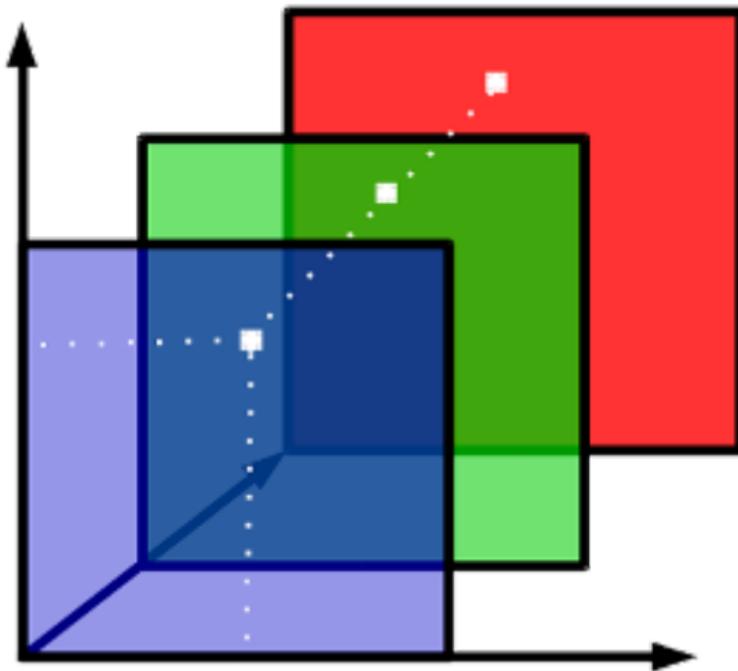
Einführung in OpenCV

Überblick

- Bildverarbeitung
- weite Verbreitung
- Matrizen als Grundlage
- Filter + Matches

Matrizen

Bild = mehrdimensionale Matrix



Filter

Berechnung auf Umgebung jedes Pixels

5	7	3	5	5	5
3	2	6	7	6	5
2	3	2	4	6	6
3	3	5	6	4	5
1	4	6	2	2	4
3	4	7	5	6	5

Filter

Beispiel dilate: helle Flächen werden größer



Filter

Beispiel dilate: helle Flächen werden größer



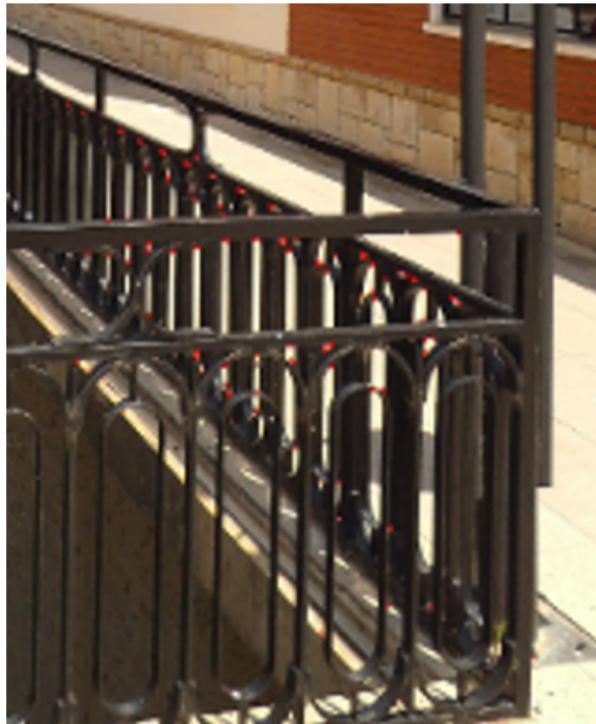
Filter

Beispiel dilate: helle Flächen werden größer



Matches

Keypoints = charakteristische Punkte



Matches

Match = Paar aus Keypoints



Motivation

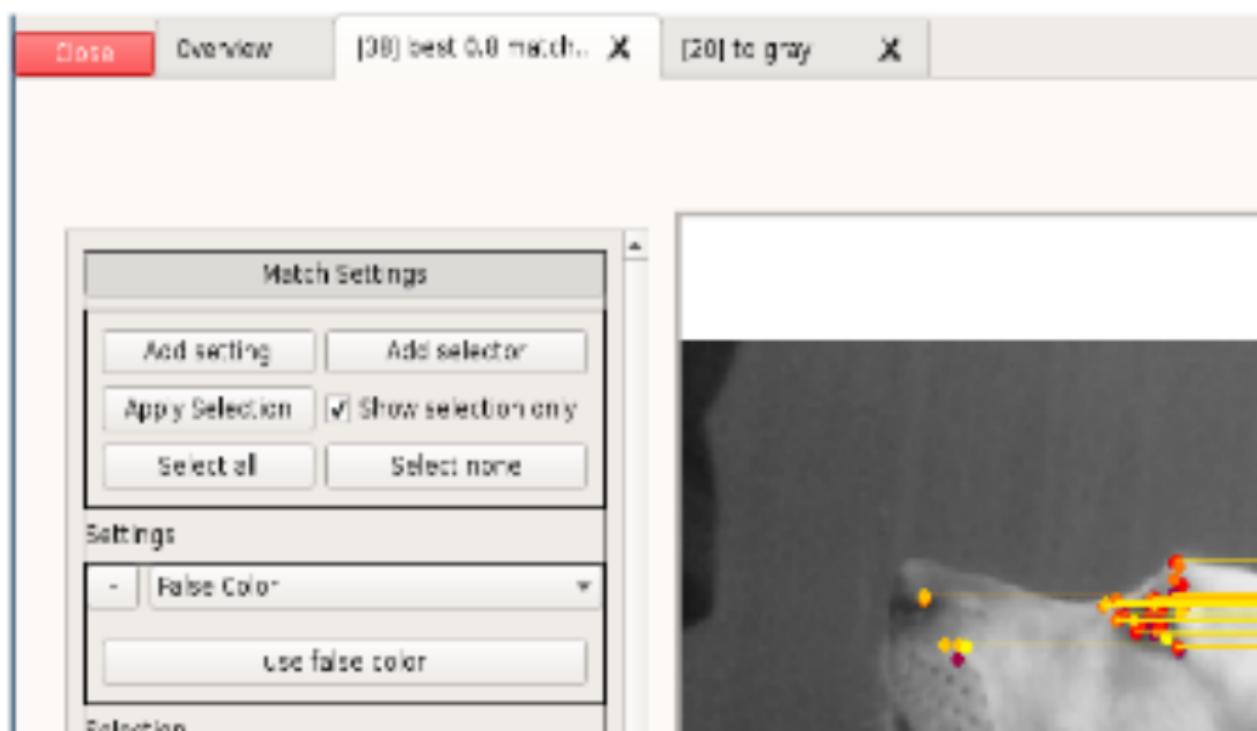
Debuggen von OpenCV

Systematisches Debugging statt „Random Code“

```
#ifdef DEBUG
    Mat img_matches;
    drawMatches( img_
        good_
        vector_
    imshow( "good match"
#endif
```

Ziele

Visualisierung von Matrizen, Filtereffekten und Matches



Anwenderfeatures

Verwendung

```
std::string imgIdString{"imgRead"};
imgIDString += toString(imgId);
cvv::showImage(imgRead, CVVISUAL_LOCATION, imgIdString);

// convert to grayscale:
cv::Mat imgGray;
cv::cvtColor(imgRead, imgGray, CV_BGR2GRAY);
cvv::debugFilter(imgRead, imgGray, CVVISUAL_LOCATION,
                 "to gray", "SingleFilterView");
```

Übersicht

Übersicht über alle Aufrufe

The screenshot shows a software interface with a light gray background. At the top left is a red rectangular button labeled "Close". To its right is a white rectangular box with a thin black border containing the word "Overview". Below these elements is a large, empty rectangular area with a thin gray border. At the bottom of the screen is a table with a black border. The table has three columns, each with a header: "ID", "Image 1", and "Image 2". The "ID" column contains a single row with the value "1". The "Image 1" and "Image 2" columns are currently empty.

ID	Image 1	Image 2
1		

Übersicht

Filterbar

The screenshot shows a software interface with a light gray background. At the top, there is a horizontal navigation bar with several items: "Einführung in OpenCV", "Motivation", "Anwenderfeatures", "GUI-Demo", "Dokumentation", "Architektur", "API", and "Ausblick". Below this, the main content area features a large red button labeled "Close" on the left and a white rectangular box labeled "Overview" on the right. A blue search bar below these elements contains the text "#type match". At the bottom, there is a table with three columns: "ID", "Image 1", and "Image 2". The "Image 1" column contains two small thumbnail images, and the "Image 2" column contains one small thumbnail image.

ID	Image 1	Image 2
1		
2		

Übersicht

Sortierbar

The screenshot shows a software interface with a light gray background. At the top right, there is a white rectangular window titled "Overview". Inside this window, on the left, is a red button labeled "Close". To the right of the button is the word "Overview". Below this window is a search bar with a blue border containing the text "#sort by line desc". At the bottom of the screen is a table with a light gray header row. The header row contains three columns with black text: "ID", "Image 1", and "Image 2".

ID	Image 1	Image 2
----	---------	---------

Übersicht

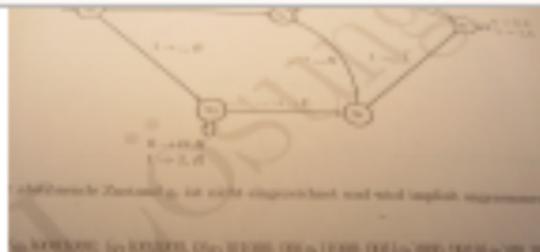
Gruppierbar

Close

Overview

#group by description

5



IMG_1454.JPG

Übersicht

Close

Overview

#group by description #sort by line desc #type ma

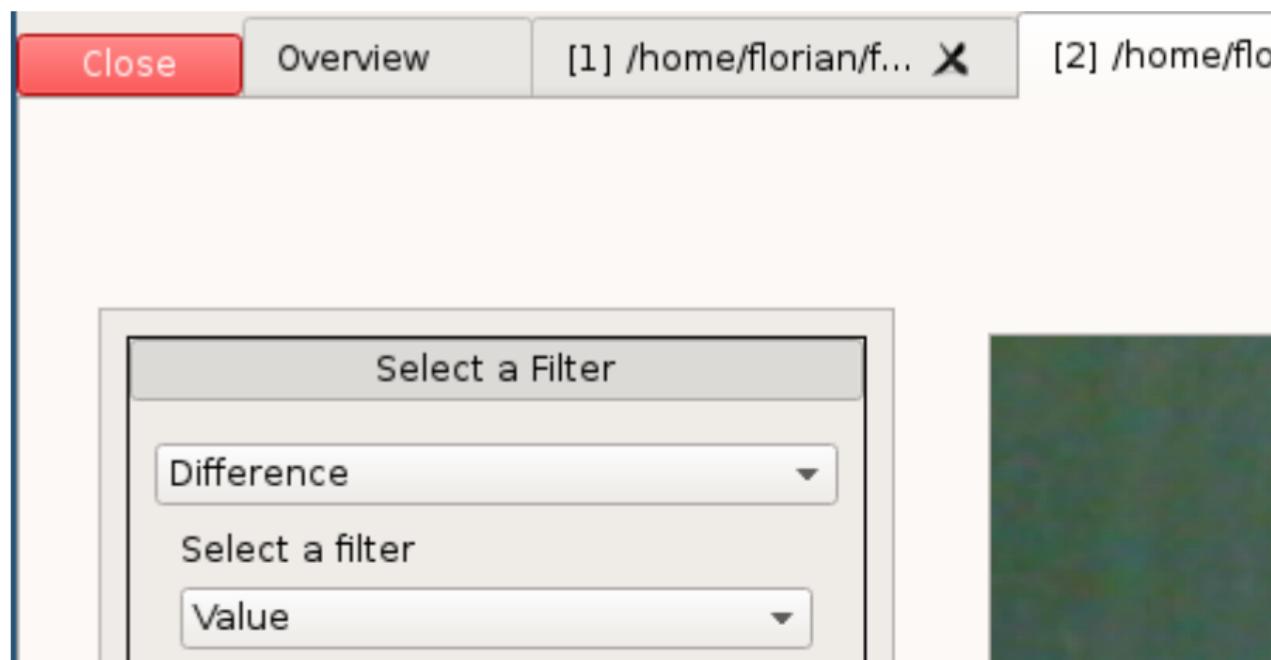
ID

Image 1

Image 2

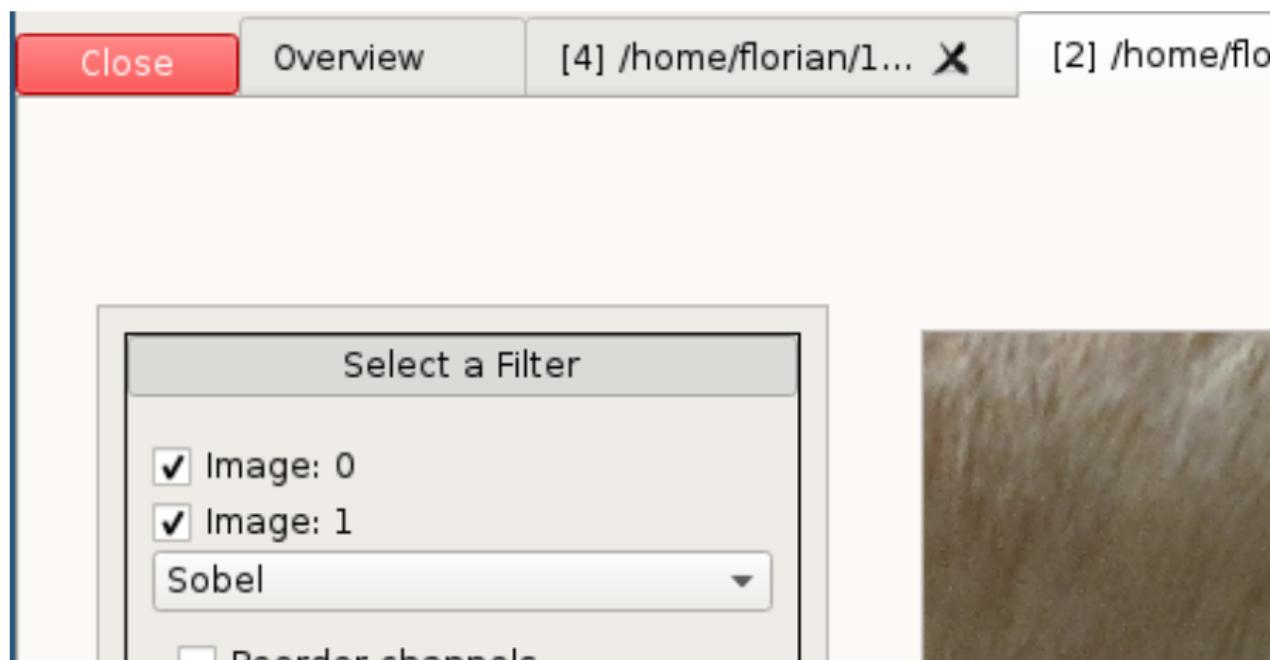
Filter

- 2 Bilder → 1 Bild
- Differenzbilder, Overlay, geänderte Pixel für Filter



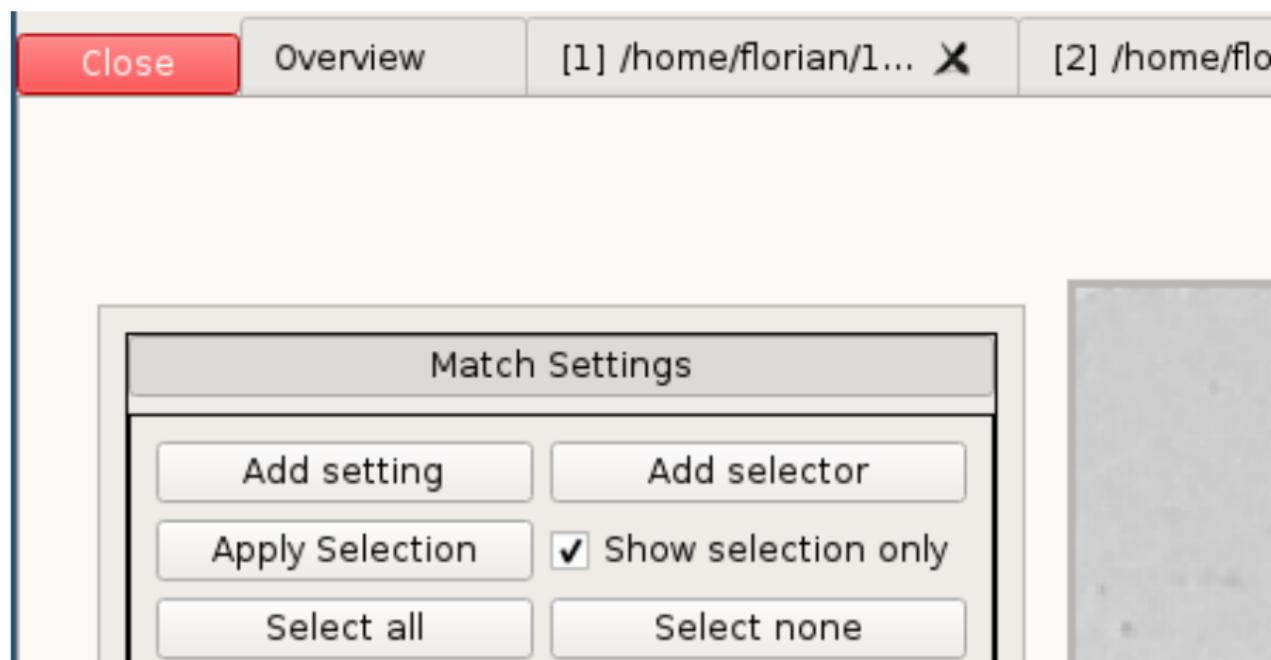
Filter

- 1 Bild → 1 Bild
- Nachträgliche Anwendung weiterer Filter



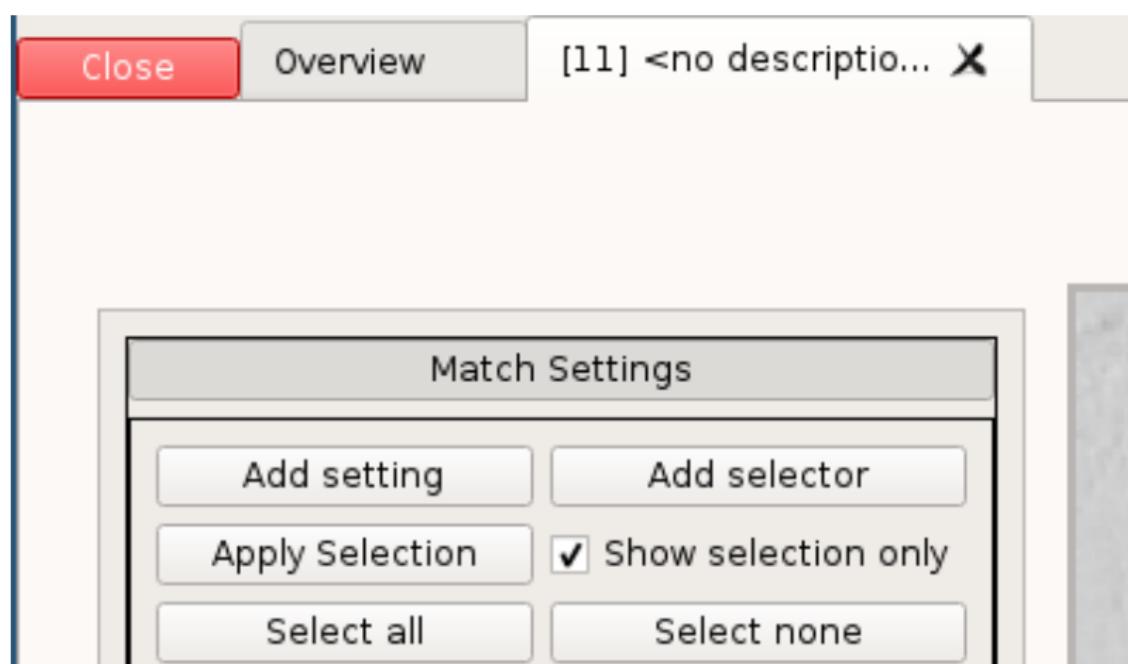
Matches

- Anzeigen / Filtern von Keypoints / Matches
- Anzeige der Verbindungen von Keypoints



Matches

- Anzeigen / Filtern von Keypoints / Matches
- Anzeige der Translation von Keypoints



GUI-Demo

Dokumentation

Tutorials, Beispiele

A screenshot of a web browser window. The address bar shows the URL `cvv.mostlynerdless.de`. The main content area displays the text "CVVisual : CVVisual Example" followed by a plus sign (+). Below this, there is a navigation bar with a back arrow icon and a globe icon.

CVVisual OpenCV debug visualization

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[Introduction to filter](#)

CVVisual

CVVisual

Kurzdokumentation

Wird von der Hilfefunktion des Programms benutzt.

CVVisual OpenCV debug visualization

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[Introduction to filter
function widgets](#)

[Über CVVisual](#)

Views

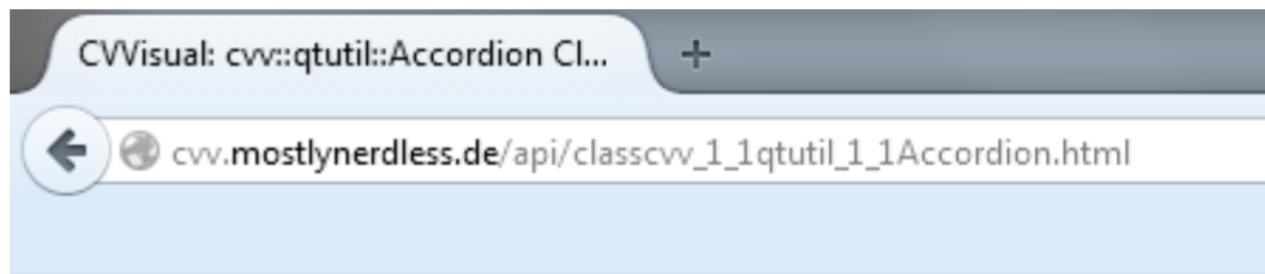
General information

Most views offer an [ImageInformation](#).
The zoom can be found here.

[Ctrl + Mouse wheel](#) is also zoom; [ctrl](#)
If the zoom is deeper than 60%, the im

Referenz:

- Mit Hilfe von Doxygen



CVVisual

A debug visualization for opencv

Main Page

Namespaces

Classes

Files

Class List

Class Index

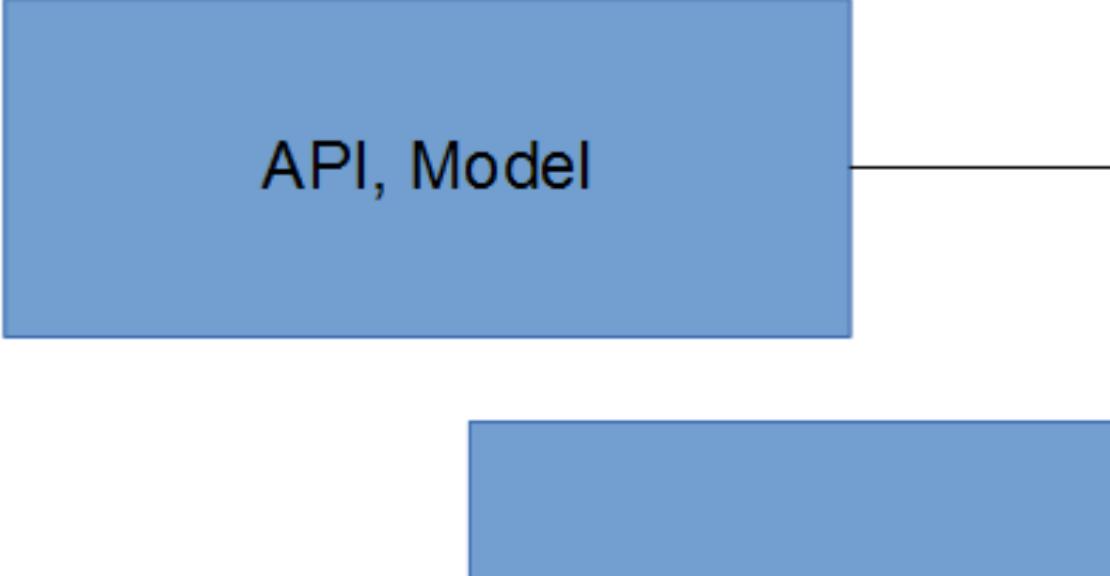
Class Hierarchy

Class Members

Architektur

Entwurf

- Trennung in API, Datenhaltung, Visualisierung



API, Model

Signals/Slots & Templates

- Qt erlaubt keine Templateklassen mit Q_OBJECT
- Signals/Slots in Objekte ausgelagert

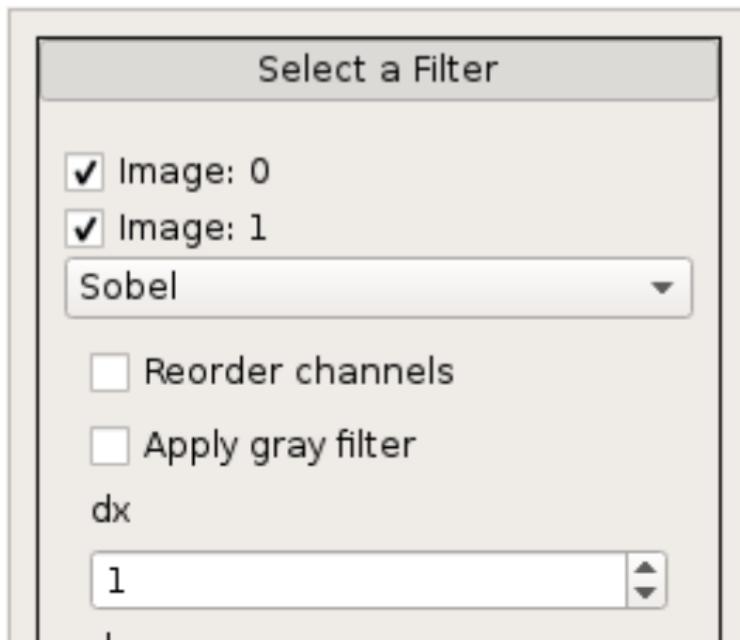
```
class SlotQString : public QObject
{
    Q_OBJECT
public:
    SlotQString(const std::function<void
        (QObject *parent) = nullptr> &parent, std::function_<
        void(QString t)> function_);
    if (!f)
        throw std::invalid_argument("SlotQString::slot");
public slots:
    void slot(QString t) const
        { function_(t); }
```

RegisterHelper

- Ermöglicht die Auswahl von Funktionen über eine Combobox
- Funktionen werden über eine API Funktion registriert

(Auto-)FilterWidget

- Unterklasse von RegisterHelper
- Ermöglicht Auswahl von Filtern
- Gibt Ergebnise per Signal weiter (z.B. an ein `ZoomableImage`)



ZoomableImage

- Umwandlung von cv::Mat in Qt Format
- Signal & Slot für Zoom Events
- Slot zum Bild wechseln
- SyncZoomWidget erlaubt synchrone Zoom
- ZoomableImageOptionPanel zeigt weiter Informationen/Optinen an

MatchScene

- Enthält 2 ZoomableImages
- Enthält die KeyPoints/Matches als QGraphicsObjects

Match distance: 1

queryIdx 0

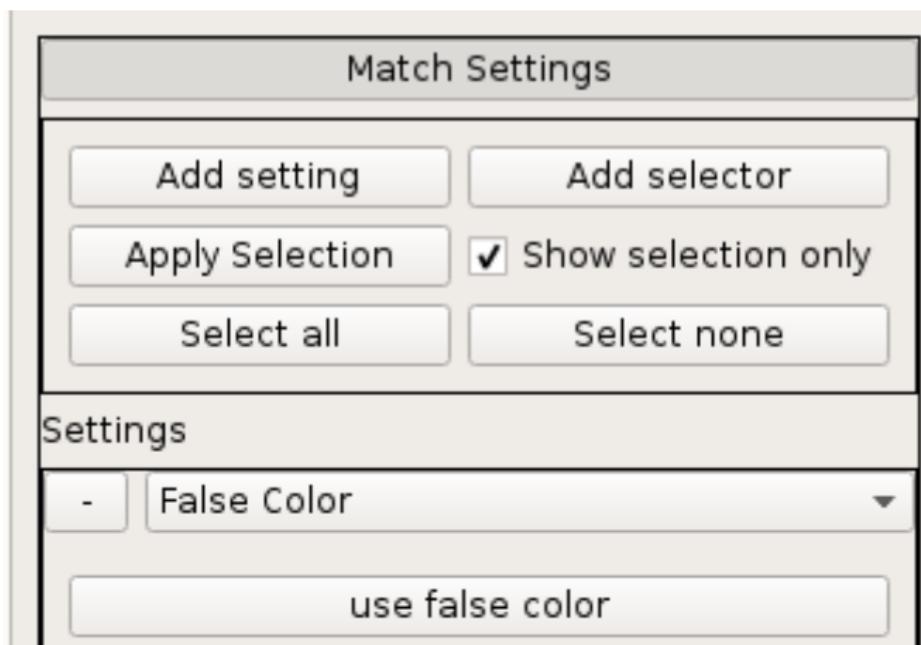
trainIdx 1

imIdx -1



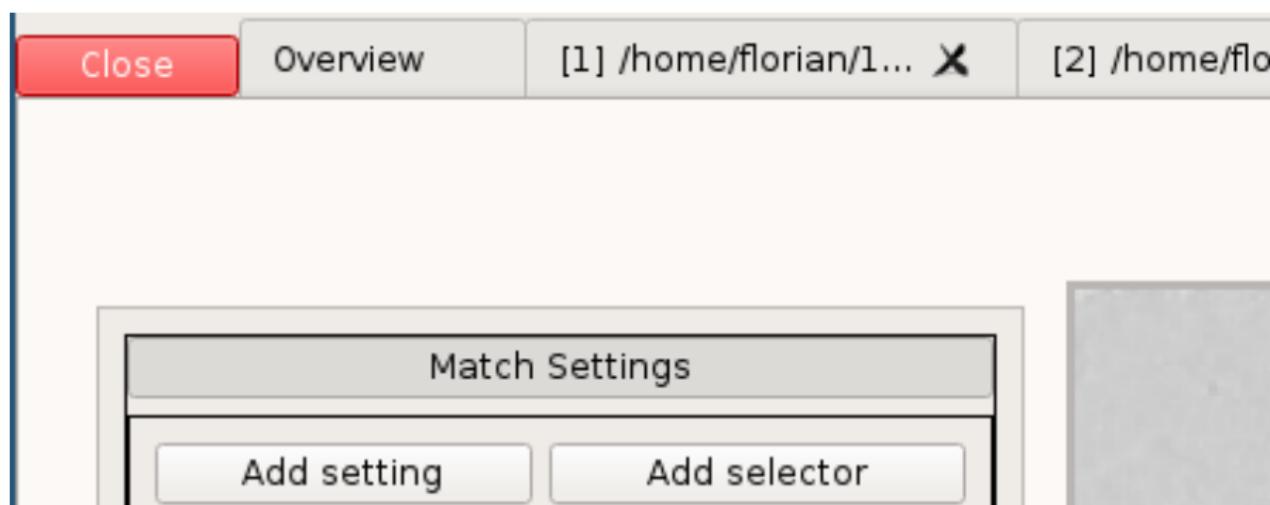
Match/KeyPointSetting

- Keine Auslagerung von Signals/Slots möglich
- Daher parallele Entwicklung von KeyPoint und MatchSetting
- Nur Selektierte KeyPoints/Matches werden angezeigt



Views

- Visualisierung der unterschiedlichen Aufrufe
- Unterscheiden sich meist in unterschiedlichen Nutzen von QT Util Klassen
- Einzige Aufgabe Weiterleitung und Annahme der Selektion (beim Wechsel der Views)



API

Anwender API

- Triviale Benutzung auch in C++98
- Sehr klein und übersichtlich

Interne API

- Erweiterung über Funktionen in `cvv::extend`
- Leichtes, zentralisiertes Hinzufügen von Visualisierungen, Filtern, Views,...

Ausblick

Rezeption

Projekt schien von der OpenCV-Community wohlwollend aufgenommen zu werden



snosov1 commented 2 days ago

Hi, Andreas!

First of all, thank you for a really valuable contribut

1 I started using OpenCV.

As **@apavlenko** suggests, this module should pro
resources we've created it, so we could easily acc

Rezeption

Nach aktuellem Stand aber aufgrund C++11 und Qt5 keine Aufnahme ins Haupt-Repo



snosov1 commented on 19. Apr.

Sorry for delay. I've looked through it right away, and they enable C++11 for builds of this repository, since the support is rather limiting.

This makes it a great tool for development and research on other platforms.

My thinking is that in its current form it doesn't belong to the

Links

- Github: <https://github.com/CVVisualPSETeam/CVVisual>
- Dokumentation: <https://cvv.mostlynerdless.de/>
- Doxygen: <https://cvv.mostlynerdless.de/api/>