CVVisual

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0.1 Gliederung

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

1 Einführung in OpenCV

1.1 Überblick

- Bildverarbeitung
- weite Verbreitung
- Matrizen als Grundlage

- Filter + Matches

1.2 Matrizen

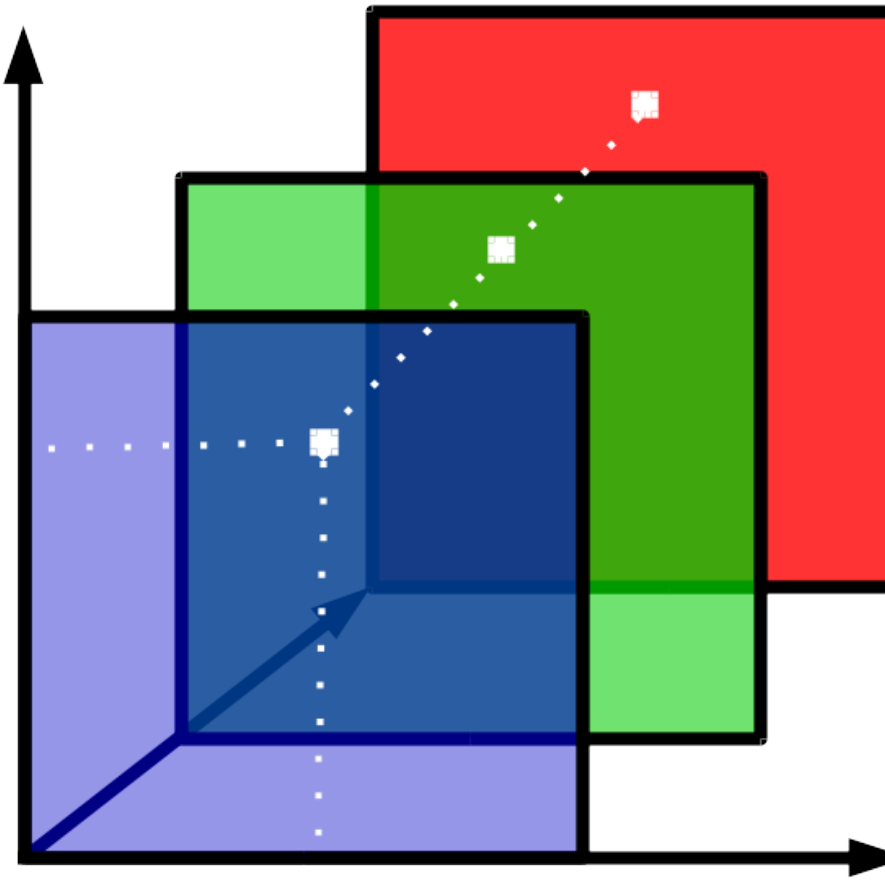


Bild = mehrdimensionale Matrix

Bsp. BGR-Bild: 1. Channel blau, 2. Channel grün usw.

1.3 Filter

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

Berechnung auf Umgebung jedes Pixels

1.4 Filter

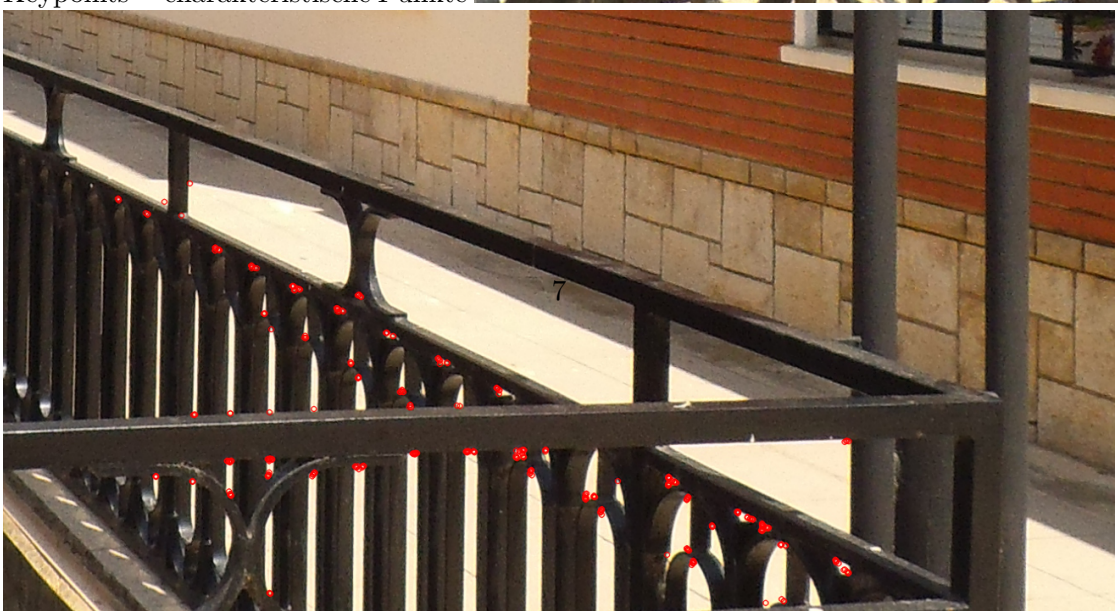
Beispiel dilate: helle Flächen werden größer

1.5 Filter

Beispiel dilate: helle Flächen werden größer  

1.6 Matches

Keypoints = charakteristische Punkte



1.7 Matches

Match = Paar aus Keypoints

2 Motivation

2.1 Debuggen von OpenCV

```
#ifdef DEBUG
        Mat img_matches;
        drawMatches( img_1, keypoints_1, img_2, keypoi
                     good_matches, img_matches, Scalar:
                     vector<char>(), DrawMatchesFlags::
        imshow("good matches", img_matches);
#endif
```

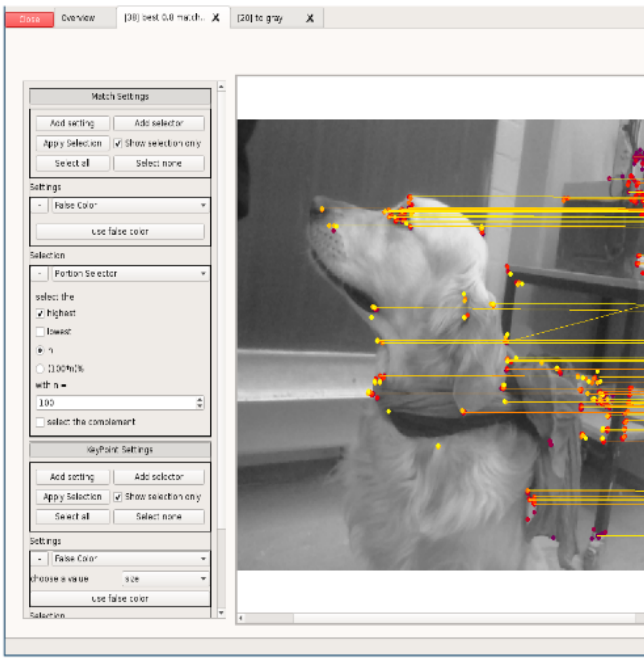
versus

```
cvv::debugMatches(img1, img2, keypoints_1, key
```

Systematisches Debugging statt „Random Code“

Hinweis auf showMatches/showKeypoints

2.2 Ziele



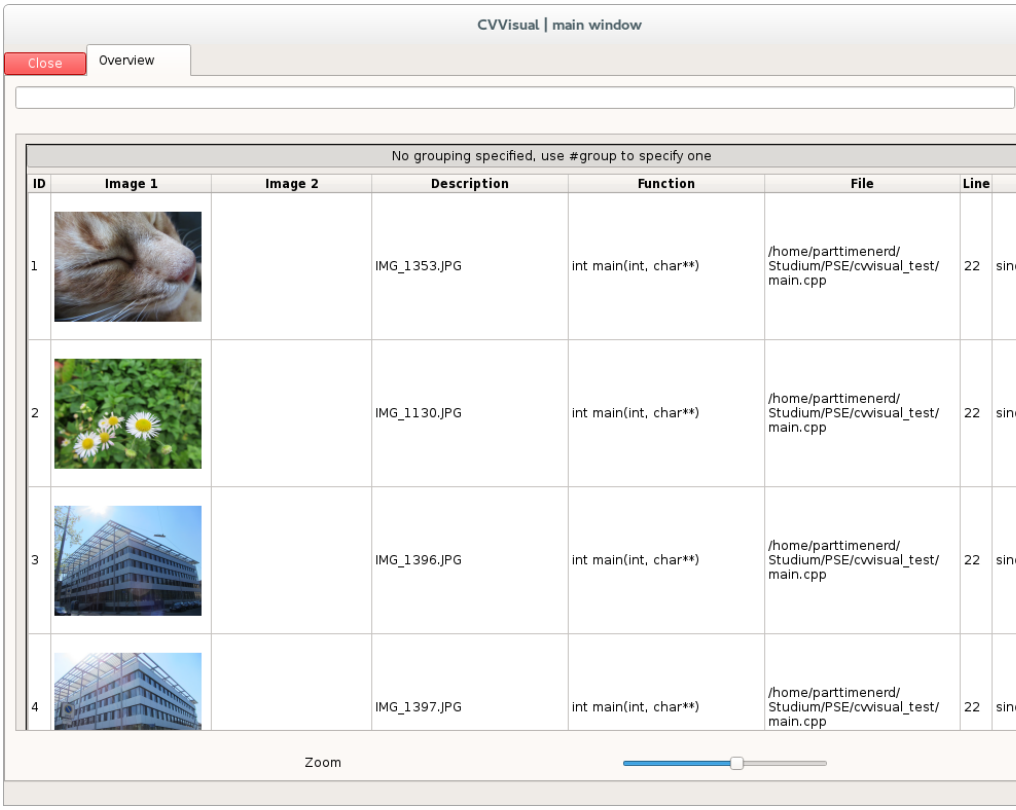
Visualisierung von Matritzen, Filtereffekten und Matches

3 Anwenderfeatures

3.1 Verwendung

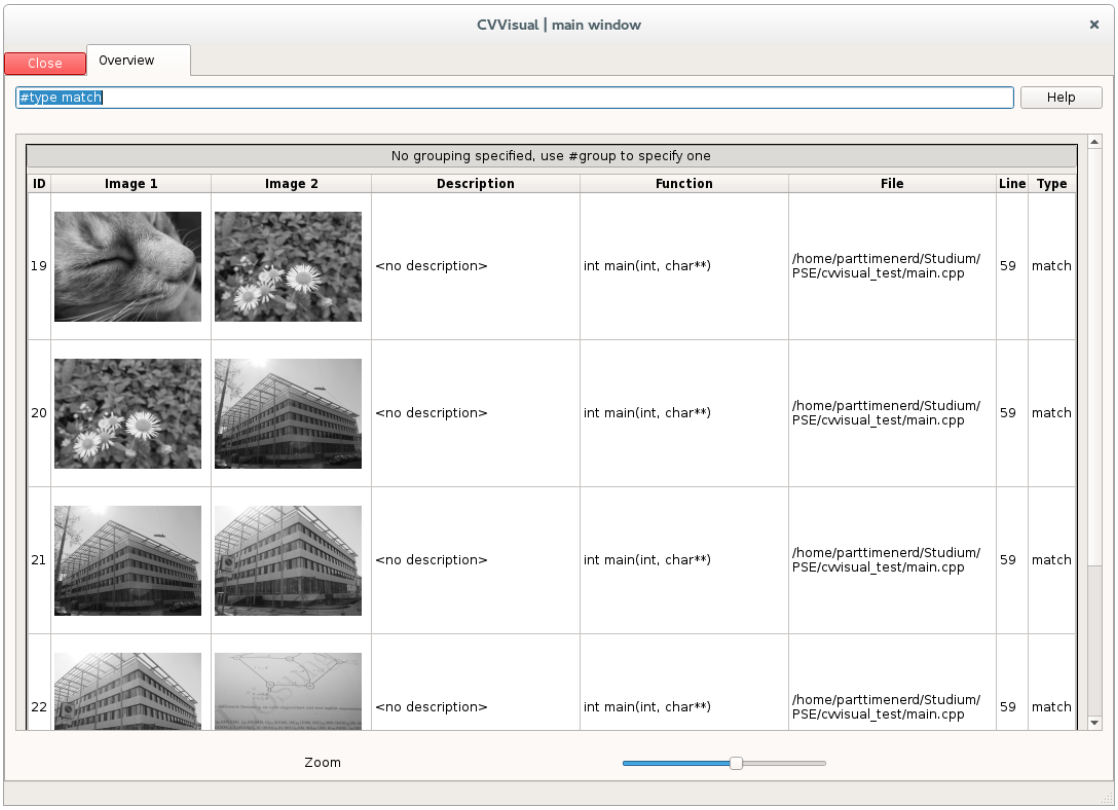
```
std::string imgIdString{"imgRead"};
imgIDString += toString(imgId);
cvv::showImage(imgRead, CVVISUAL_LOCATION, imgIdString);

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

3.2 Übersicht



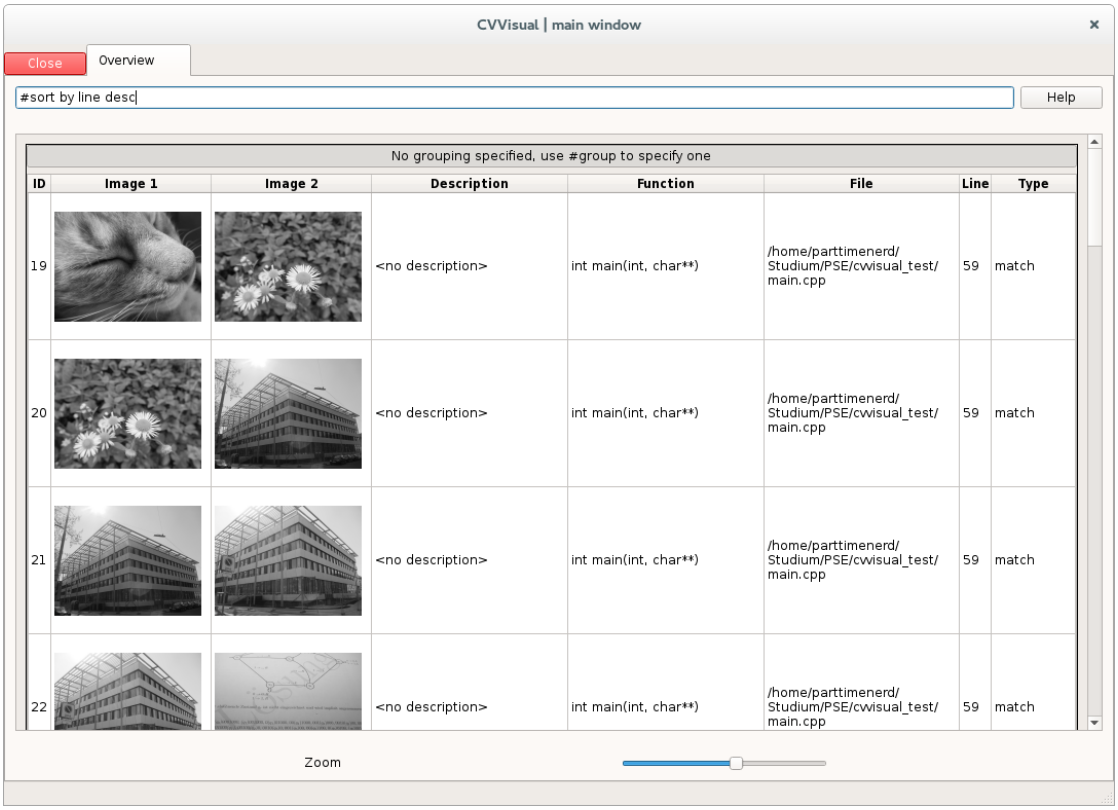
Übersicht über alle Aufrufe

3.3 Übersicht



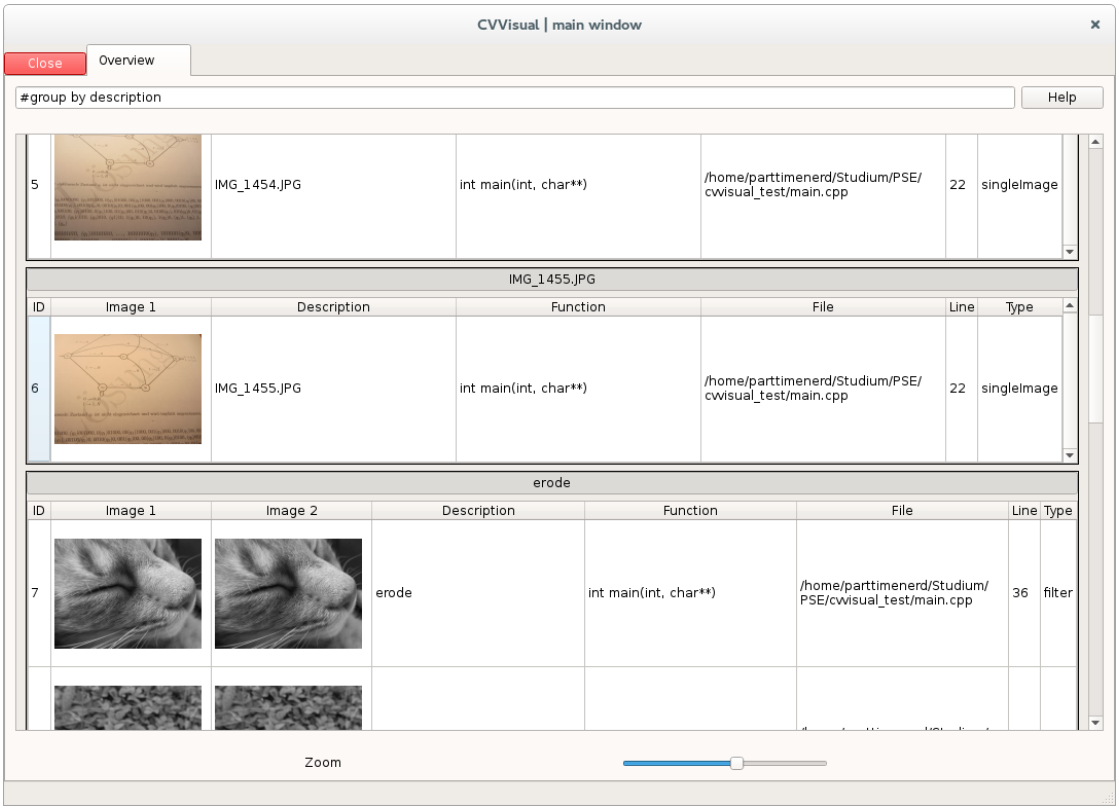
Filterbar

3.4 Übersicht



Sortierbar

3.5 Übersicht

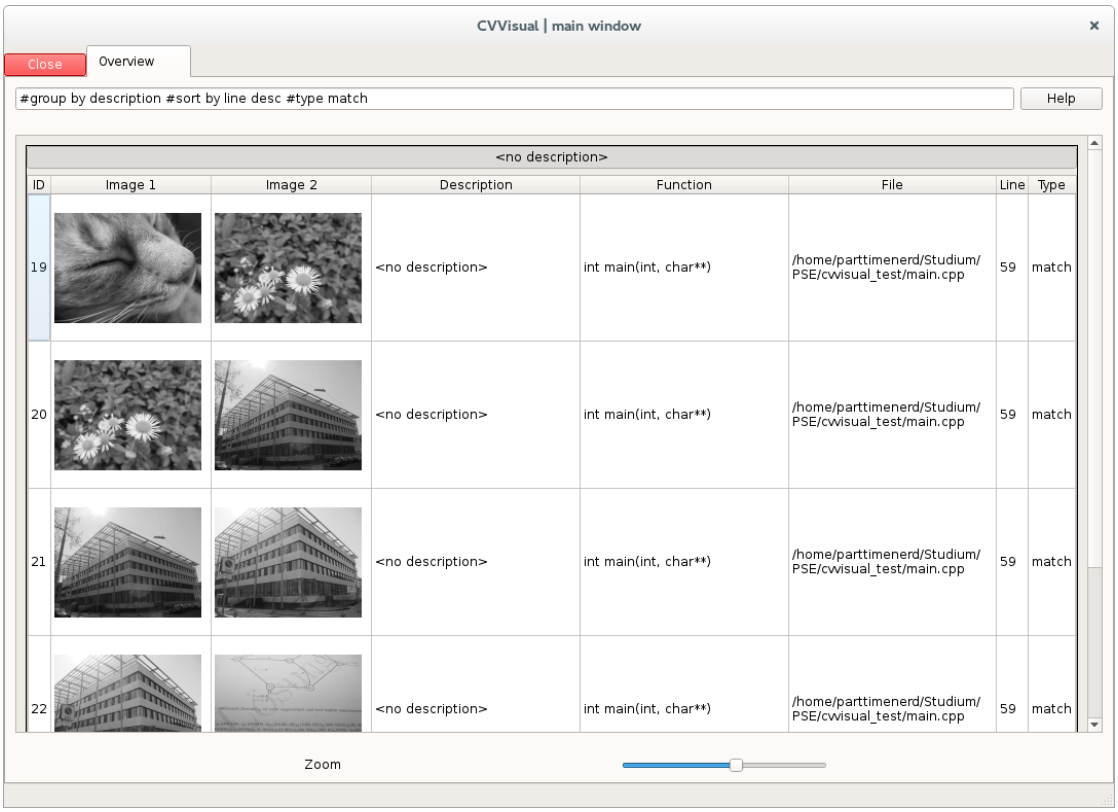


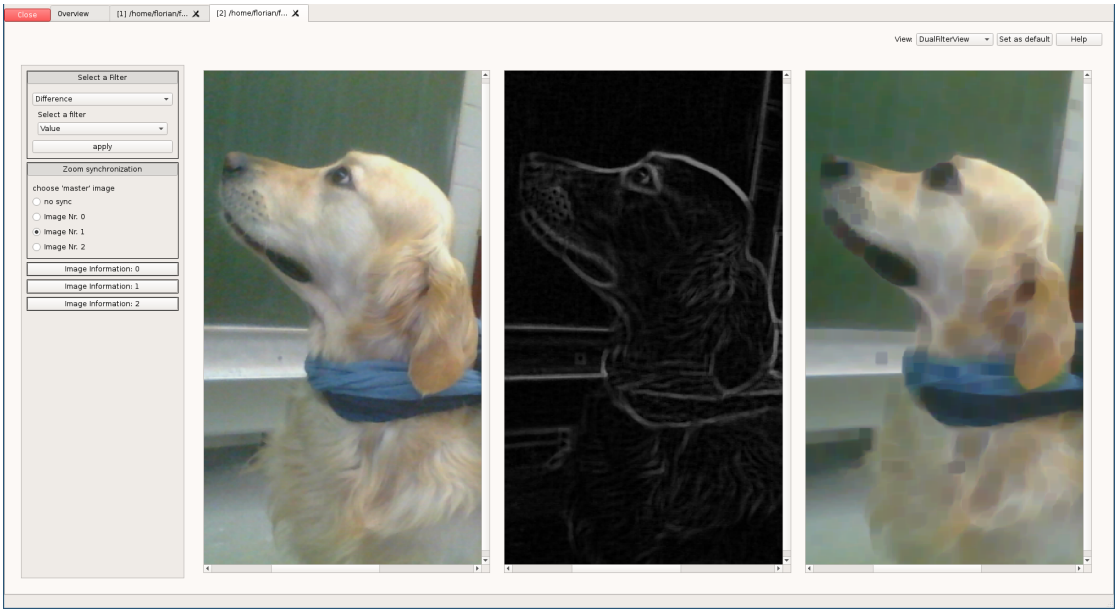
Gruppierbar

3.6 Übersicht

3.7 Filter

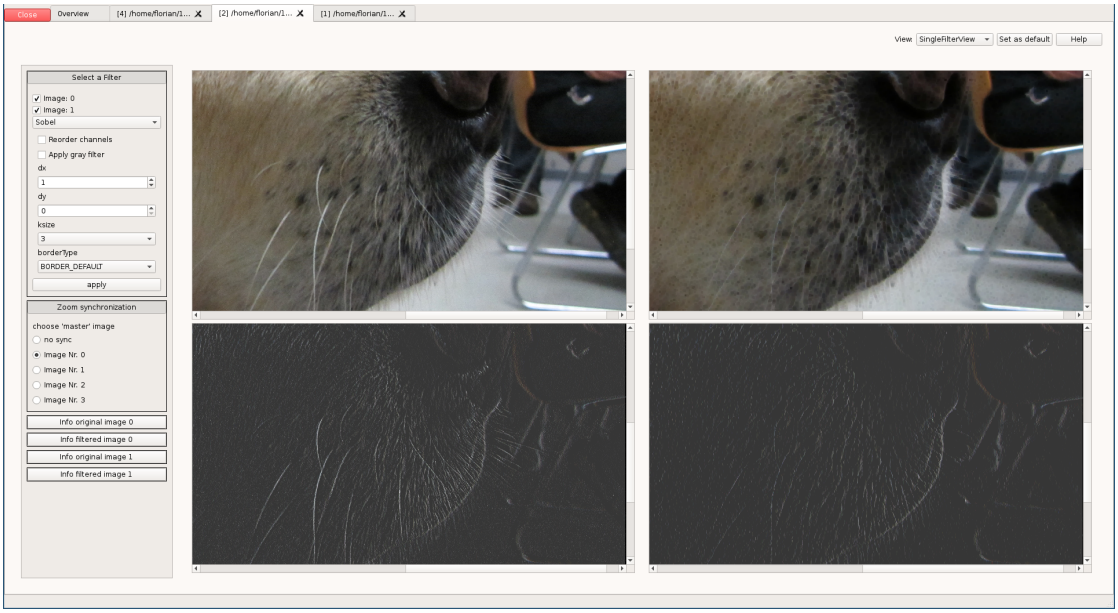
- 2 Bilder → 1 Bild
- Differenzbilder, Overlay, geänderte Pixel für Filter


CVVisual | main window
Close
Overview
#group by description #sort by line desc #type match
Help
<no description>
ID
Image 1
Image 2
Description
Function
File
Line
Type
19
<no description>
int main(int, char**)
/home/parttimenerd/Studium/PSE/cvvisual_test/main.cpp
59
match
20
<no description>
int main(int, char**)
/home/parttimenerd/Studium/PSE/cvvisual_test/main.cpp
59
match
21
<no description>
int main(int, char**)
/home/parttimenerd/Studium/PSE/cvvisual_test/main.cpp
59
match
22
<no description>
int main(int, char**)
/home/parttimenerd/Studium/PSE/cvvisual_test/main.cpp
59
match
Zoom



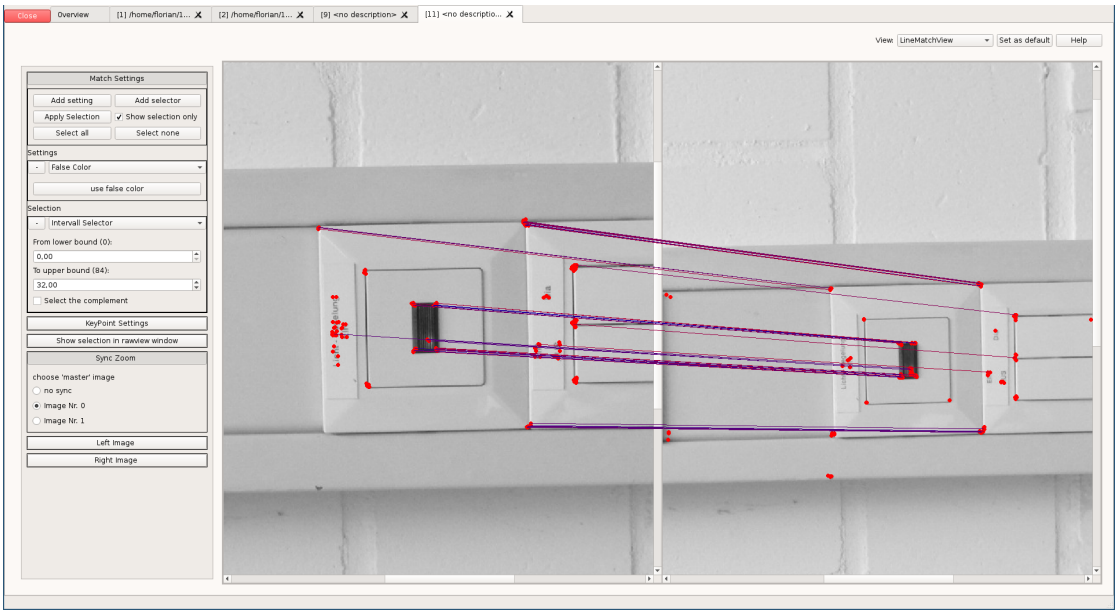
3.8 Filter

- 1 Bild → 1 Bild
- Nachträgliche Anwendung weiterer Filter



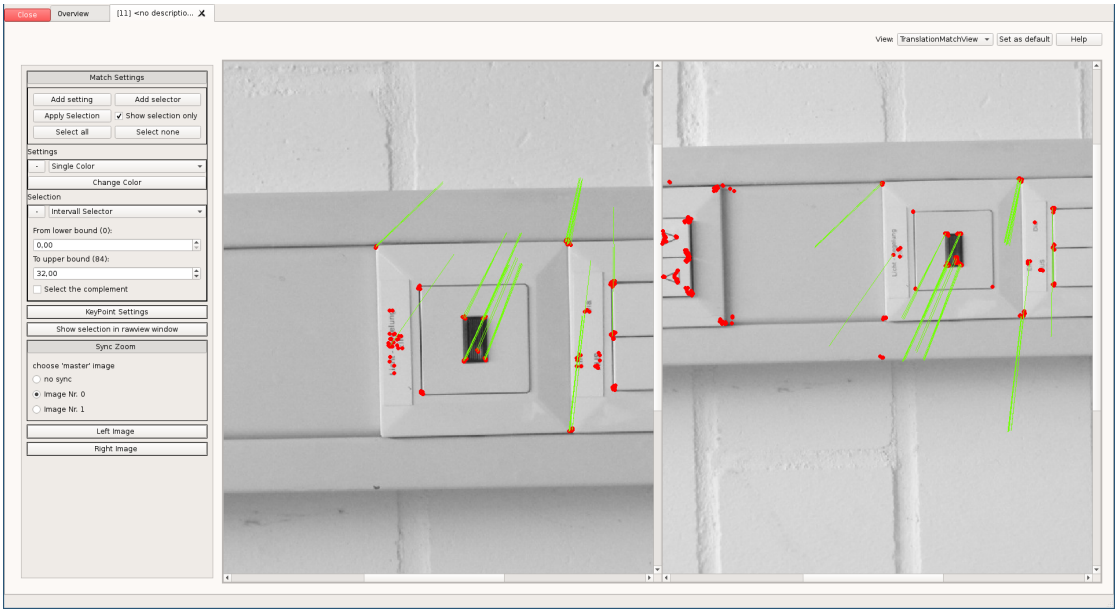
3.9 Matches

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



3.10 Matches

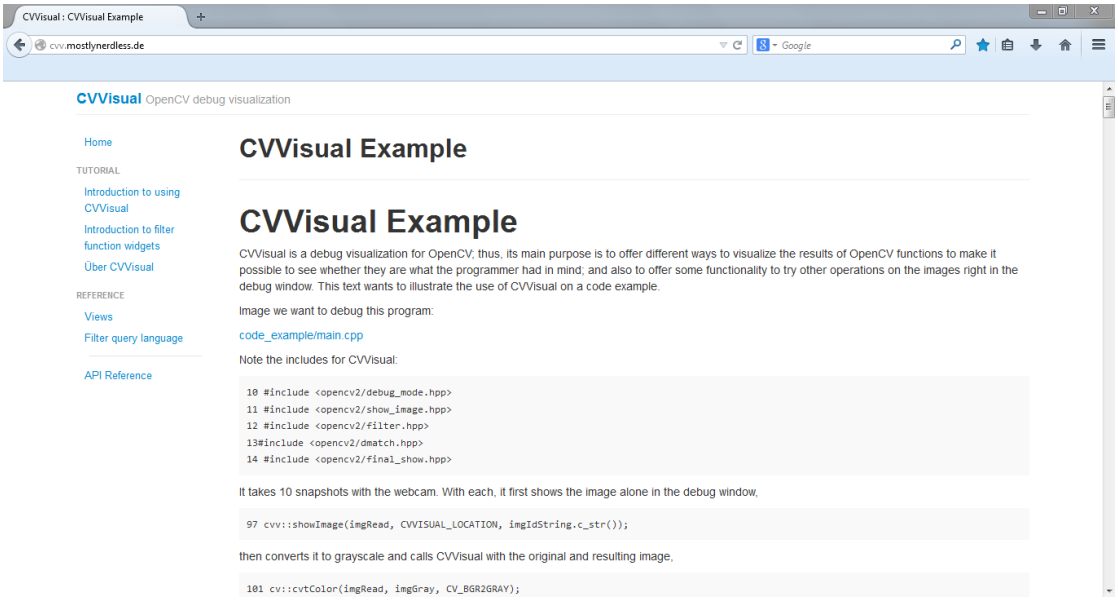
- Anzeigen / Filtern von Keypoints / Matches
- Anzeige der Translation von Keypoints



4 GUI-Demo

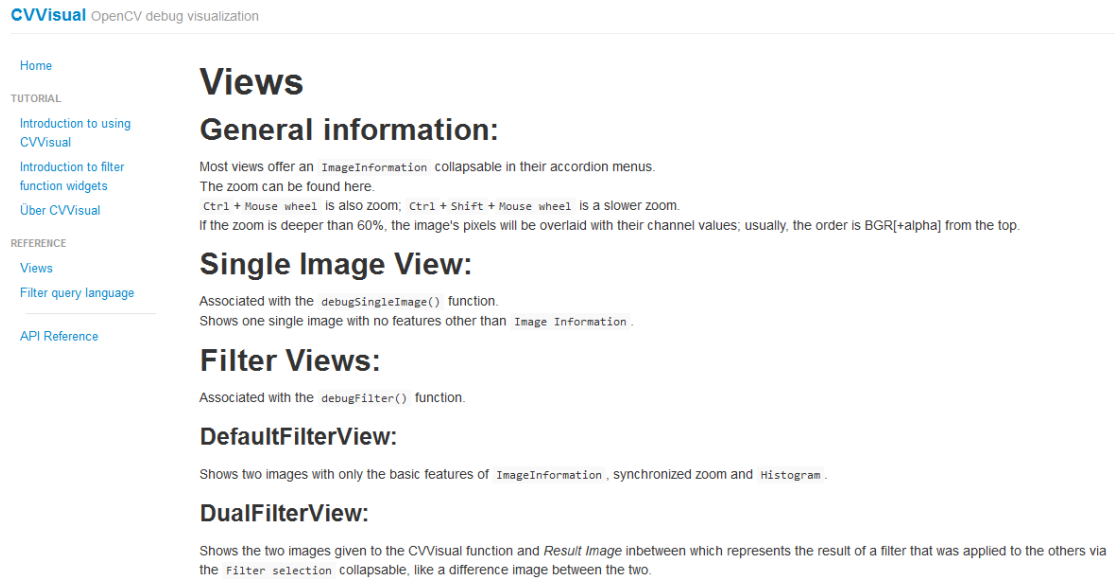
5 Dokumentation

5.1 Tutorials, Beispiele



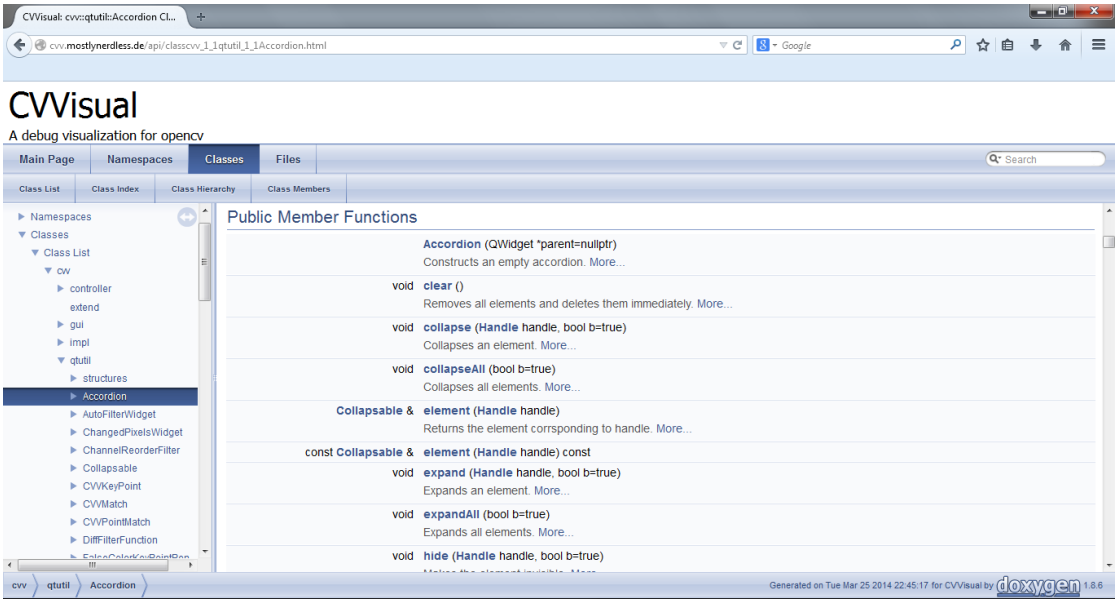
5.2 Kurzdokumentation

Wird von der Hilfefunktion des Programms benutzt.



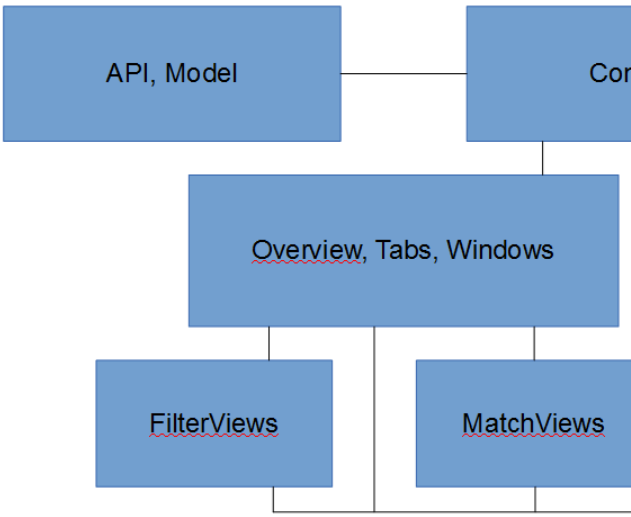
5.3 Referenz:

- Mit Hilfe von Doxygen



6 Architektur

6.1 Entwurf



- Trennung in API, Datenhaltung, Visualisierung

6.2 Signals/Slots & Templates

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

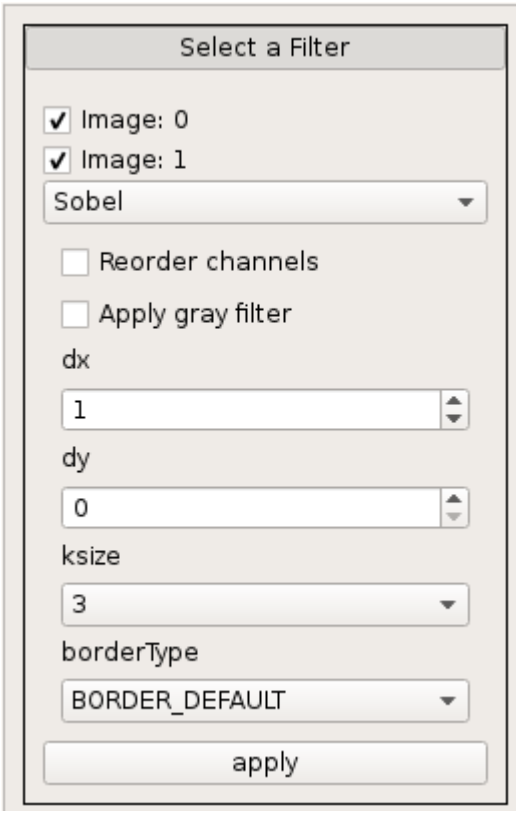
```
class SlotQString : public QObject
{    Q_OBJECT
  public:
    SlotQString(const std::function<void(QString)> &f,
                QObject *parent = nullptr)
    : QObject{ parent }, function_{ f }
    {    if (!f)
             throw std::invalid_argument{ "invalic
    }
public slots:
    void slot(QString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

6.3 RegisterHelper

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

6.4 (Auto-)FilterWidget

- Unterklasse von RegisterHelper
- Ermöglicht Auswahl von Filtern



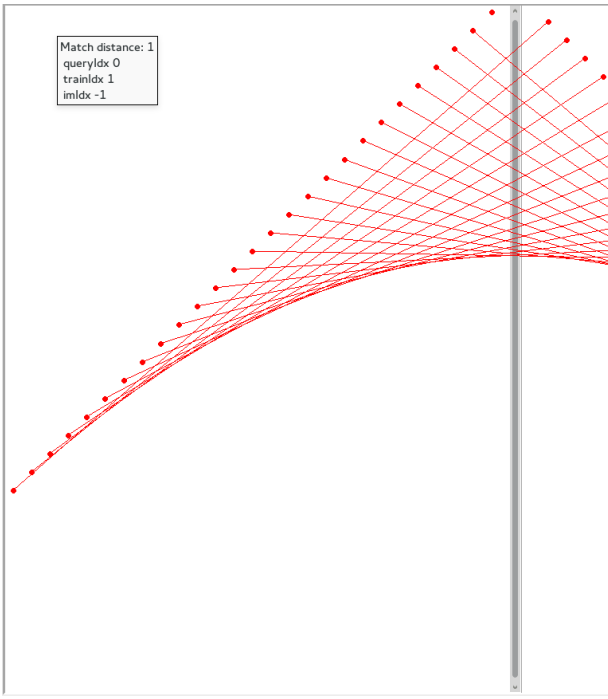
- Gibt Ergebnise per Signal weiter (z.B. an ein ZoomableImage)

6.5 ZoomableImage

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

6.6 MatchScene

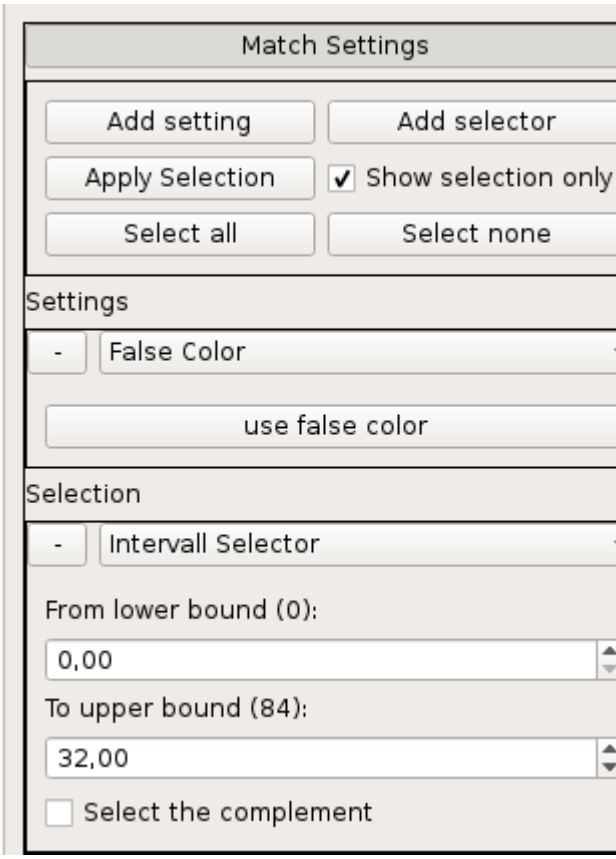
- Enthält 2 ZoomableImages



- Enthält die KeyPoints/Matches als QGraphicsObjects

6.7 Match/KeyPointSetting

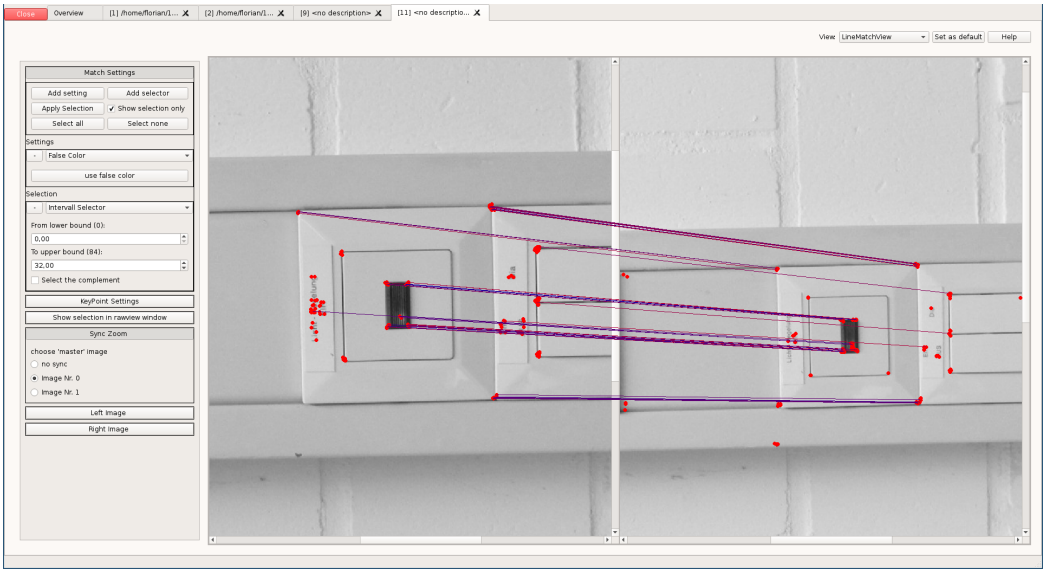
- Keine Auslagerung von Singals/Slots möglich
- Daher parallele Entwicklung von KeyPoint und MatchSetting



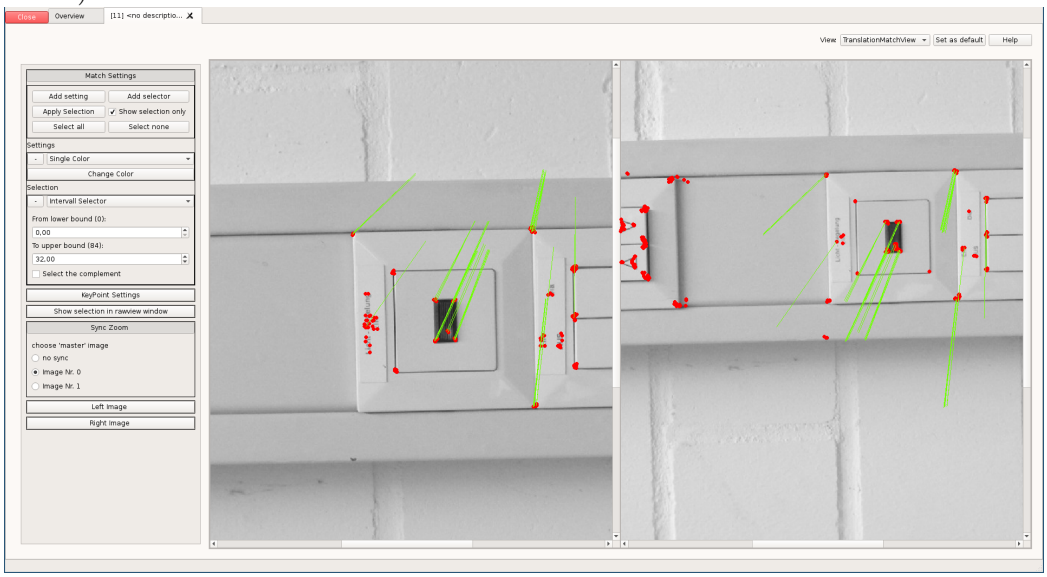
- Nur Selektierte KeyPoints/Matches werden angezeigt

6.8 Views

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



Views)



7 API

7.1 Anwender API

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

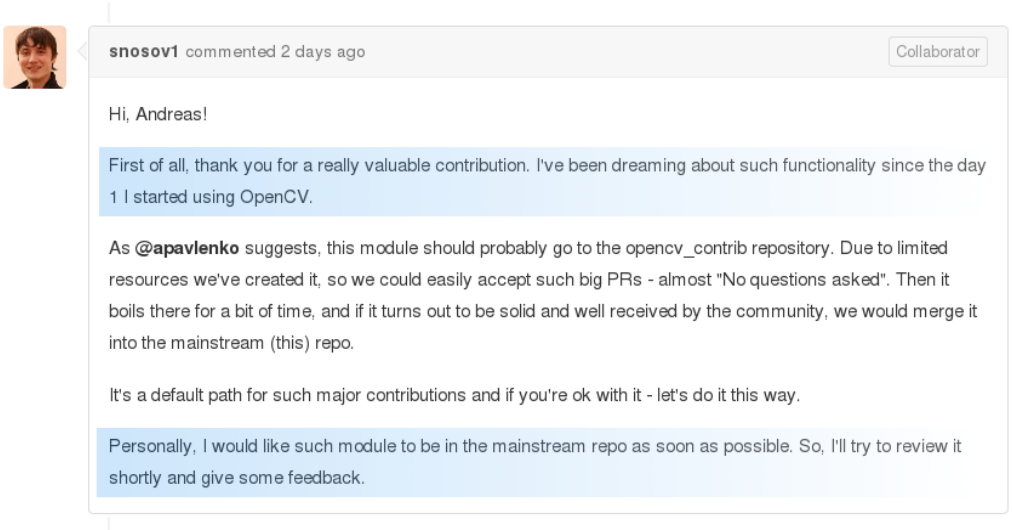
7.2 Interne API

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

8 Ausblick

8.1 Rezeption

Projekt schien von der OpenCV-Community wohlwollend aufgenommen zu werden



snosov1 commented 2 days ago — Collaborator

Hi, Andreas!

First of all, thank you for a really valuable contribution. I've been dreaming about such functionality since the day 1 I started using OpenCV.

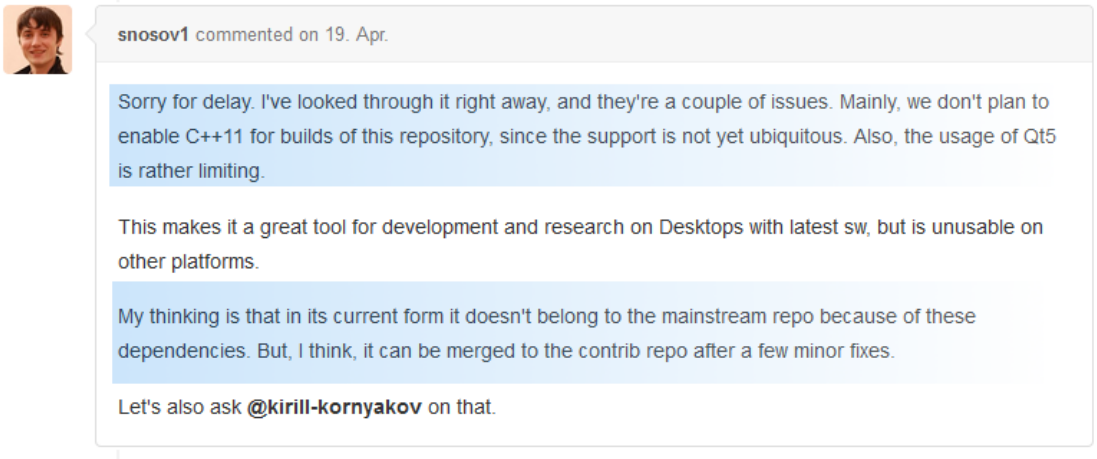
As **@apavlenko** suggests, this module should probably go to the opencv_contrib repository. Due to limited resources we've created it, so we could easily accept such big PRs - almost "No questions asked". Then it boils there for a bit of time, and if it turns out to be solid and well received by the community, we would merge it into the mainstream (this) repo.

It's a default path for such major contributions and if you're ok with it - let's do it this way.

Personally, I would like such module to be in the mainstream repo as soon as possible. So, I'll try to review it shortly and give some feedback.

8.2 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're a couple of issues. Mainly, we don't plan to enable C++11 for builds of this repository, since the support is not yet ubiquitous. Also, the usage of Qt5 is rather limiting.

This makes it a great tool for development and research on Desktops with latest sw, but is unusable on other platforms.

My thinking is that in its current form it doesn't belong to the mainstream repo because of these dependencies. But, I think, it can be merged to the contrib repo after a few minor fixes.

Let's also ask **@kirill-kornyakov** on that.

8.3 Links

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