CVVisual

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0.1 Gliederung

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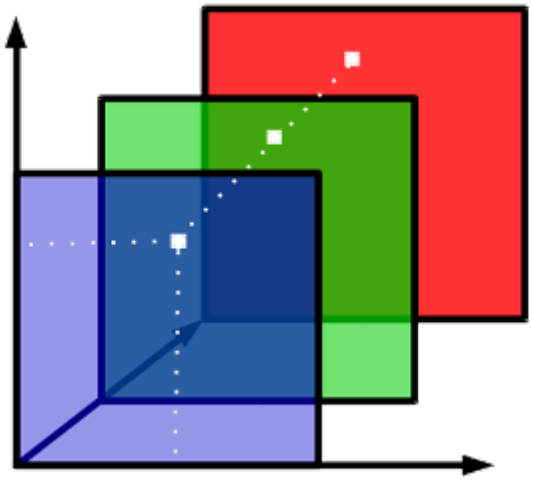
1 Einführung in OpenCV

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

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

1.4 Filter

Beispiel dilate: helle Flächen werden größer

1.5 Filter

Beispiel dilate: helle Flächen werden größer

1.6 Filter

Beispiel dilate: helle Flächen werden größer

1.7 Matches

Keypoints = charakteristische Punkte

1.8 Matches

Match = Paar aus Keypoints

2 Motivation

2.1 Debuggen von OpenCV

Systematisches Debugging statt „Random Code“

```
#ifdef DEBUG
        Mat img_matches;
        drawMatches( img_1, keypoints_1, img_2, keypoints_2,
                     good_matches, img_matches, Scalar::all(-1), Scalar::all(-1),
                     vector<char>(), DrawMatchesFlags::NOT_DRAW_SINGLE_POINTS );
        imshow("good matches", img_matches);
#endif
```

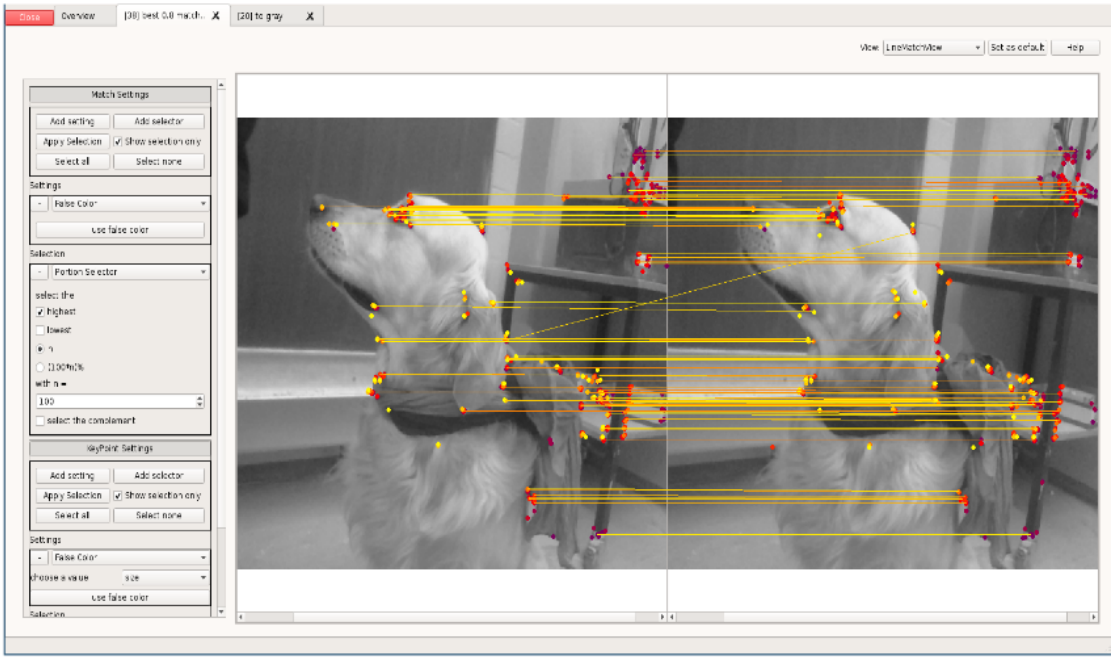
versus

```
        cvv::debugMatches(img1, img2, keypoints_1, keypoints_2, good_matches);
```

Hinweis auf showMatches/showKeypoints

2.2 Ziele

Visualisierung von Matritzen, Filtereffekten und Matches



3 Anwenderfeatures

3.1 Verwendung

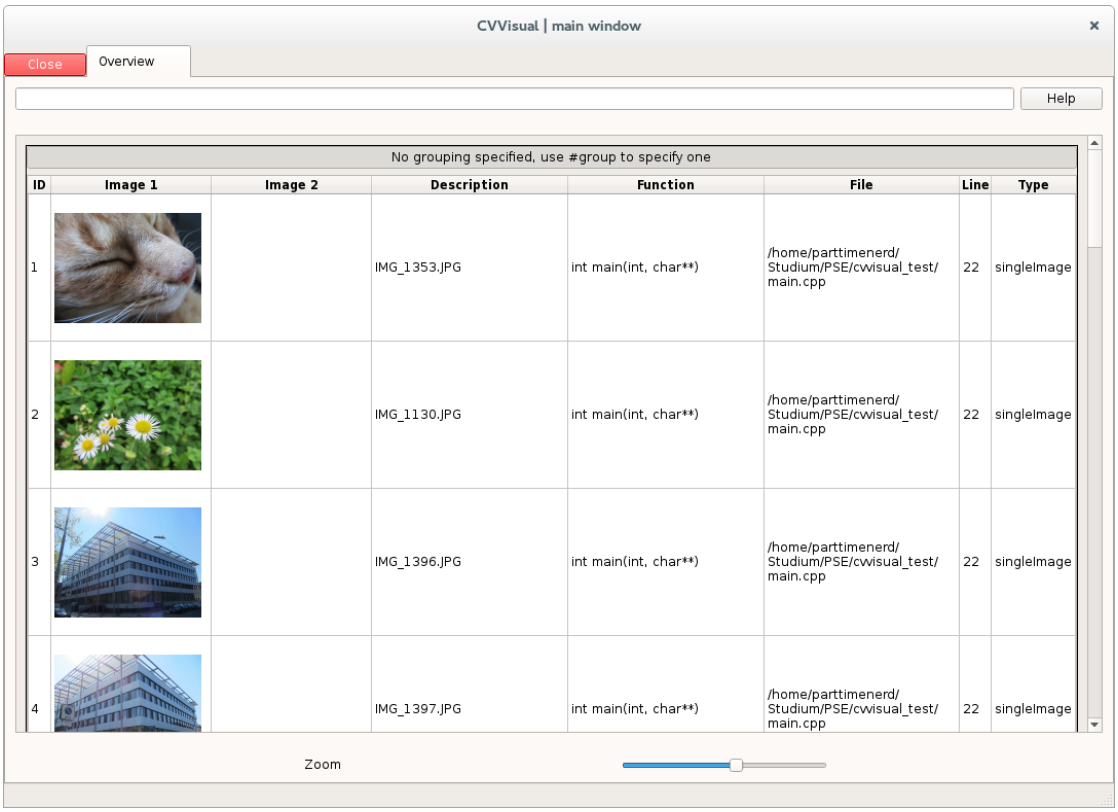
```
std::string imgIdString = "imgRead" + toString(imgId);
cvv::showImage(imgRead, CVVISUAL_LOCATION, imgIdString);

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

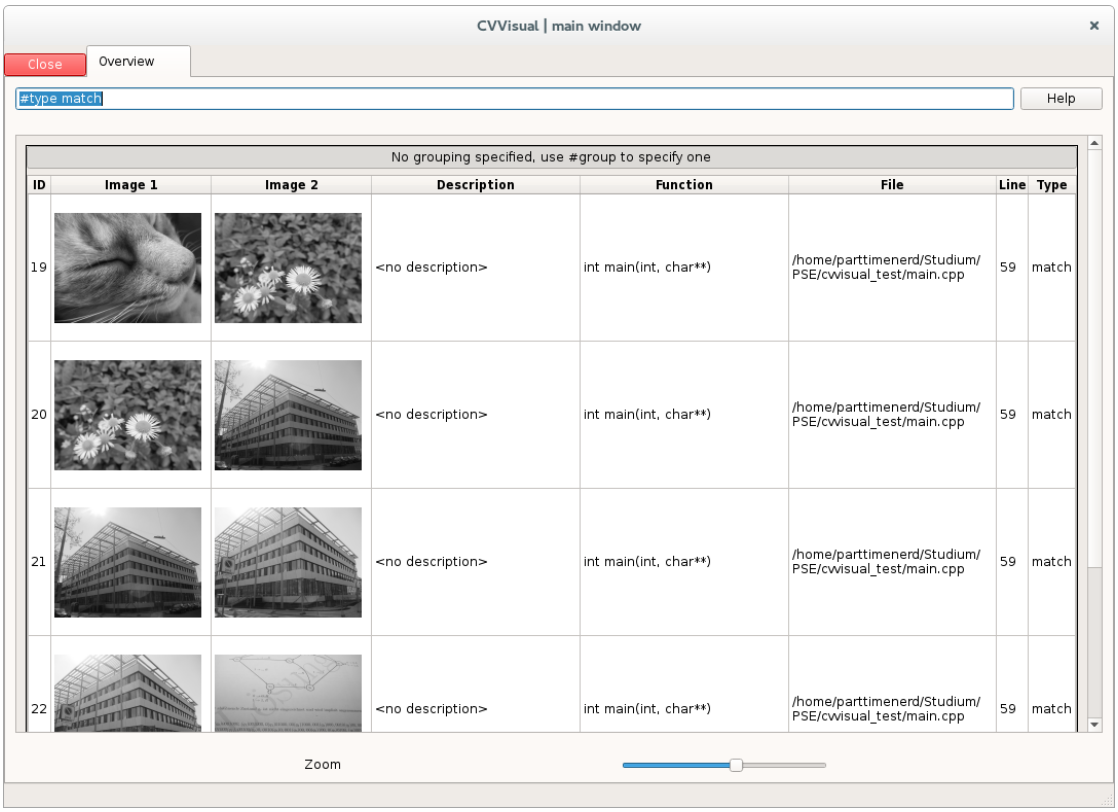
3.2 Übersicht

Übersicht über alle Aufrufe

3.3 Übersicht

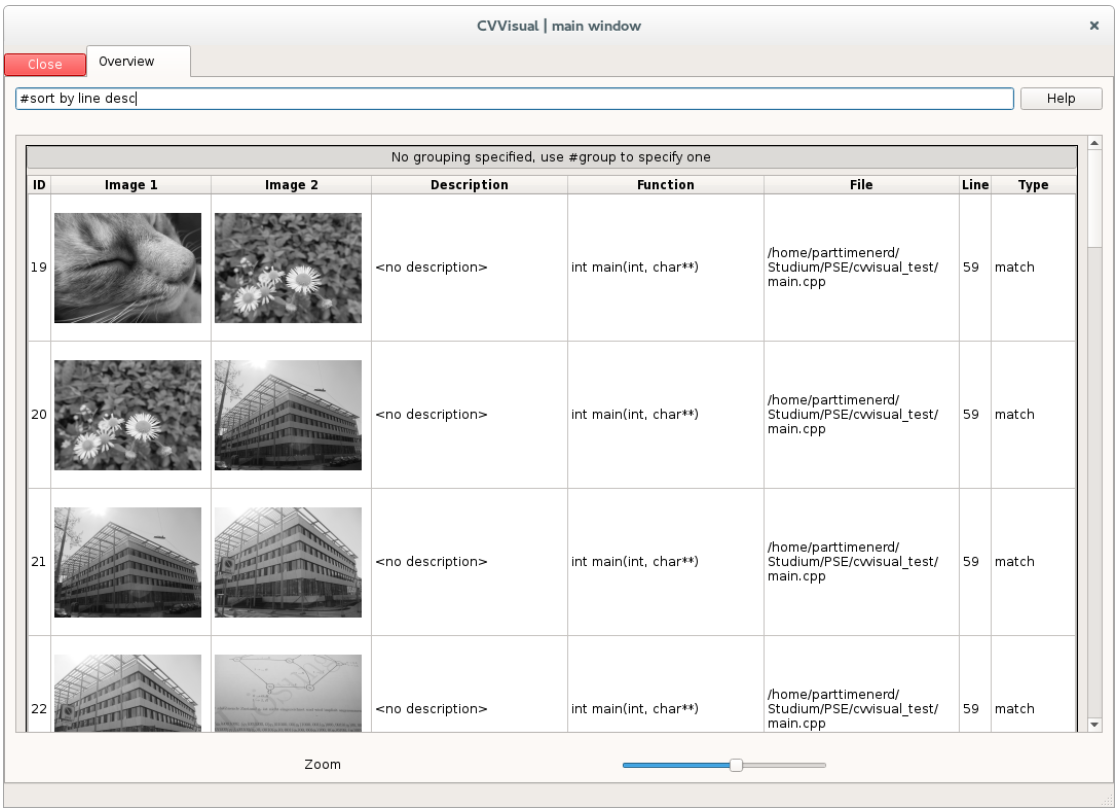
Filterbar


CVVisual | main window
Close
Overview
Help
No grouping specified, use #group to specify one
ID
Image 1
Image 2
Description
Function
File
Line
Type
1
IMG_1353.JPG
int main(int, char**)
/home/parttimenerd/Studium/PSE/cvvisual_test/main.cpp
22
singleImage
2
IMG_1130.JPG
int main(int, char**)
/home/parttimenerd/Studium/PSE/cvvisual_test/main.cpp
22
singleImage
3
IMG_1396.JPG
int main(int, char**)
/home/parttimenerd/Studium/PSE/cvvisual_test/main.cpp
22
singleImage
4
IMG_1397.JPG
int main(int, char**)
/home/parttimenerd/Studium/PSE/cvvisual_test/main.cpp
22
singleImage
Zoom


CVVisual | main window
Close
Overview
#type match
Help
No grouping specified, use #group to specify one
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

3.4 Übersicht

Sortierbar



3.5 Übersicht

Gruppierbar

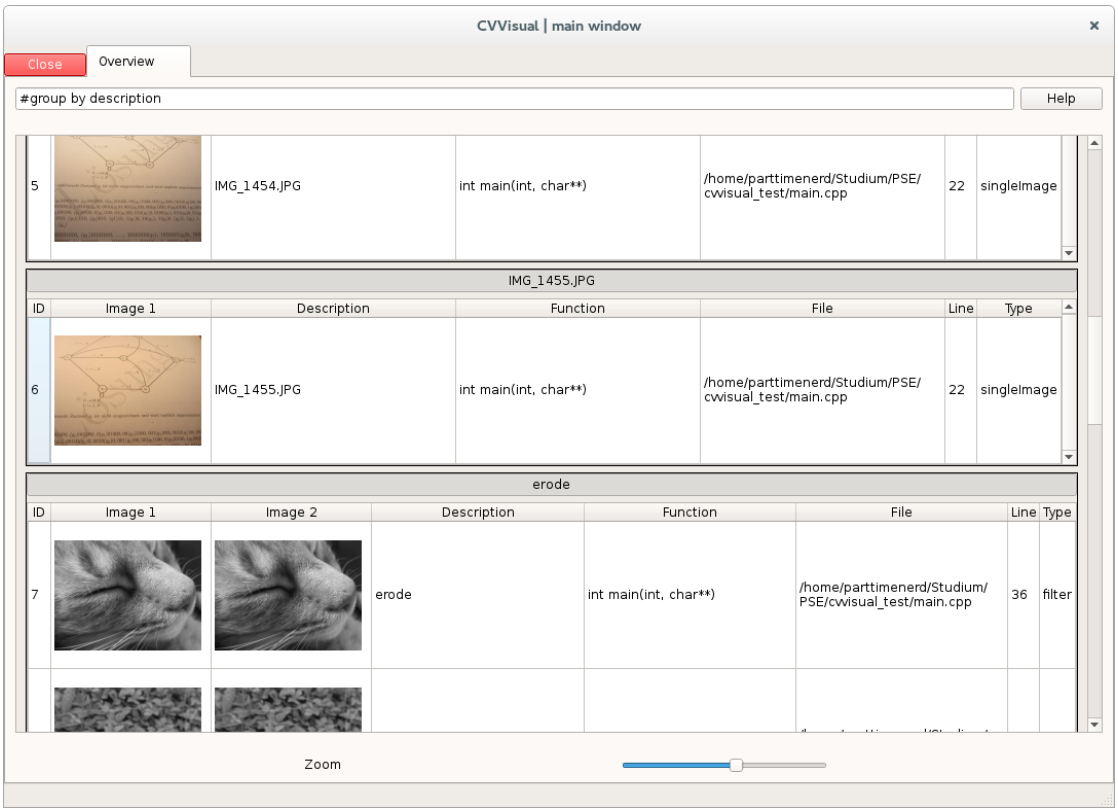
3.6 Übersicht

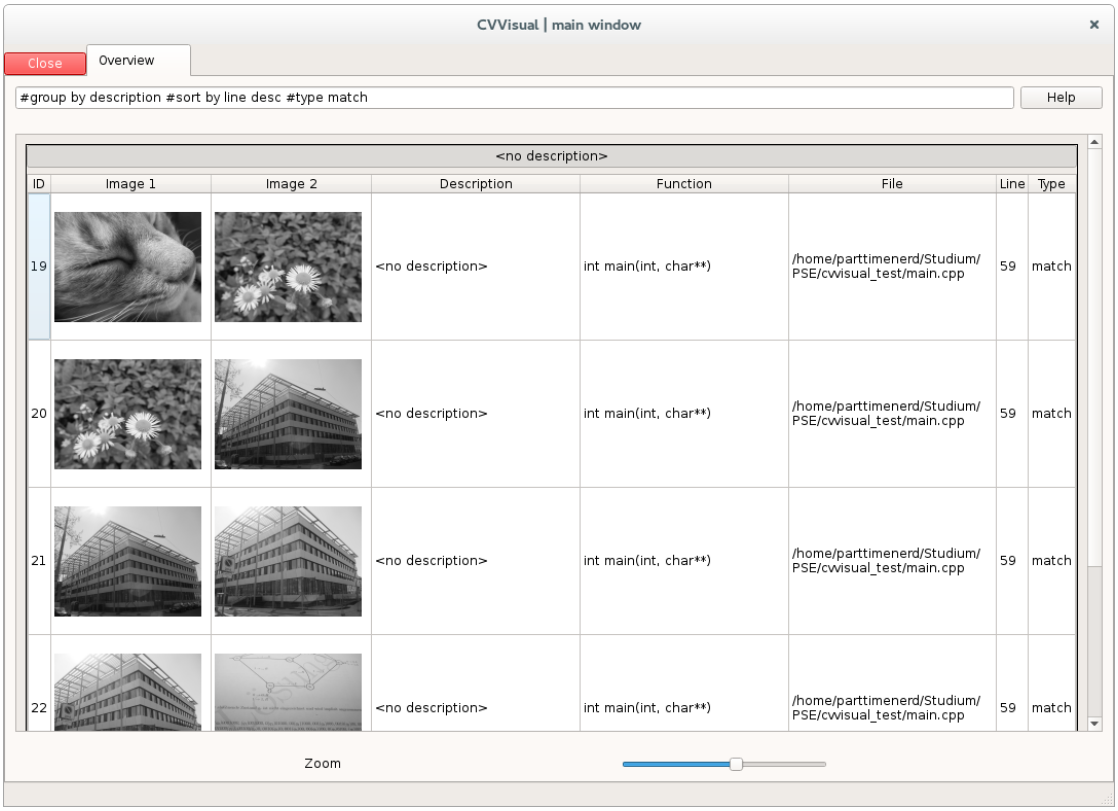
3.7 Filter

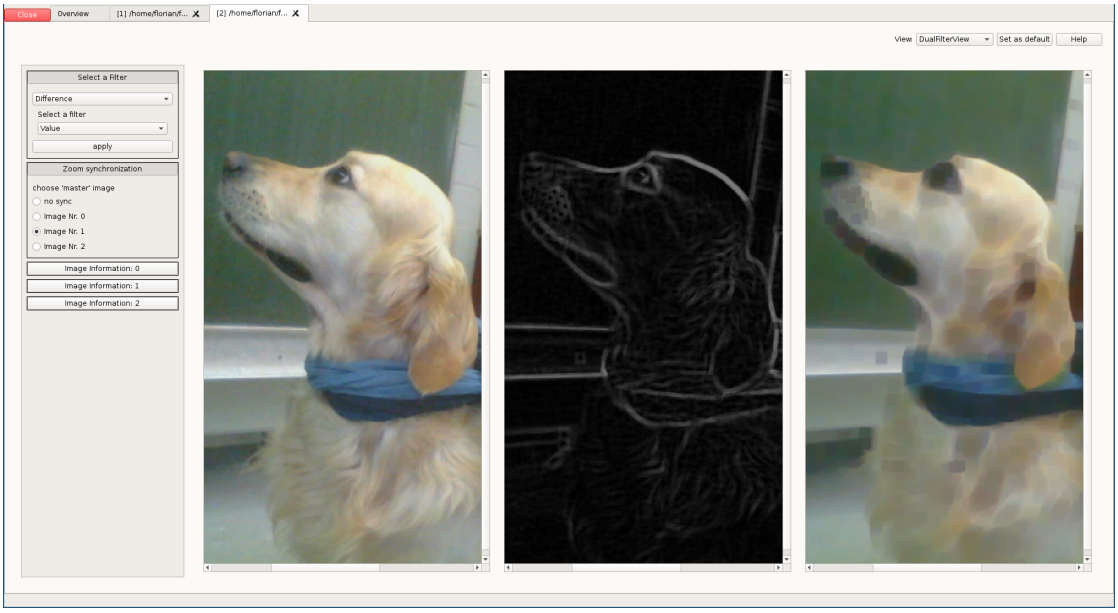
- 2 Bilder → 1 Bild
- Differenzbilder, Overlay, geänderte Pixel für Filter

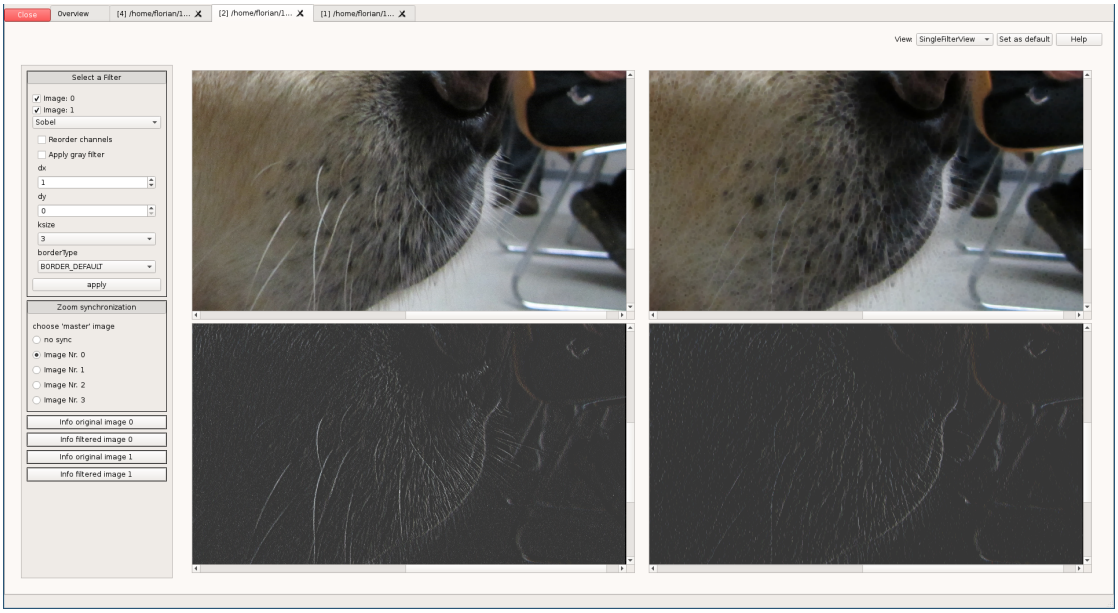
3.8 Filter

- 1 Bild → 1 Bild
- Nachträgliche Anwendung weiterer Filter


CVVisual | main window
Close
Overview
#group by description
Help
5
IMG_1454.JPG
int main(int, char**)
/home/parttimenerd/Studium/PSE/cvvisual_test/main.cpp
22
singleImage
IMG_1455.JPG
ID
Image 1
Description
Function
File
Line
Type
6
IMG_1455.JPG
int main(int, char**)
/home/parttimenerd/Studium/PSE/cvvisual_test/main.cpp
22
singleImage
erode
ID
Image 1
Image 2
Description
Function
File
Line
Type
7
erode
int main(int, char**)
/home/parttimenerd/Studium/PSE/cvvisual_test/main.cpp
36
filter
Zoom


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


Close
Overview
View
DualFilterView
Set as default
Help
Select a Filter
Difference
Select a filter
Value
apply
Zoom synchronization
choose 'master' image
no sync
Image Nr. 0
Image Nr. 1
Image Nr. 2
Image Information: 0
Image Information: 1
Image Information: 2



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

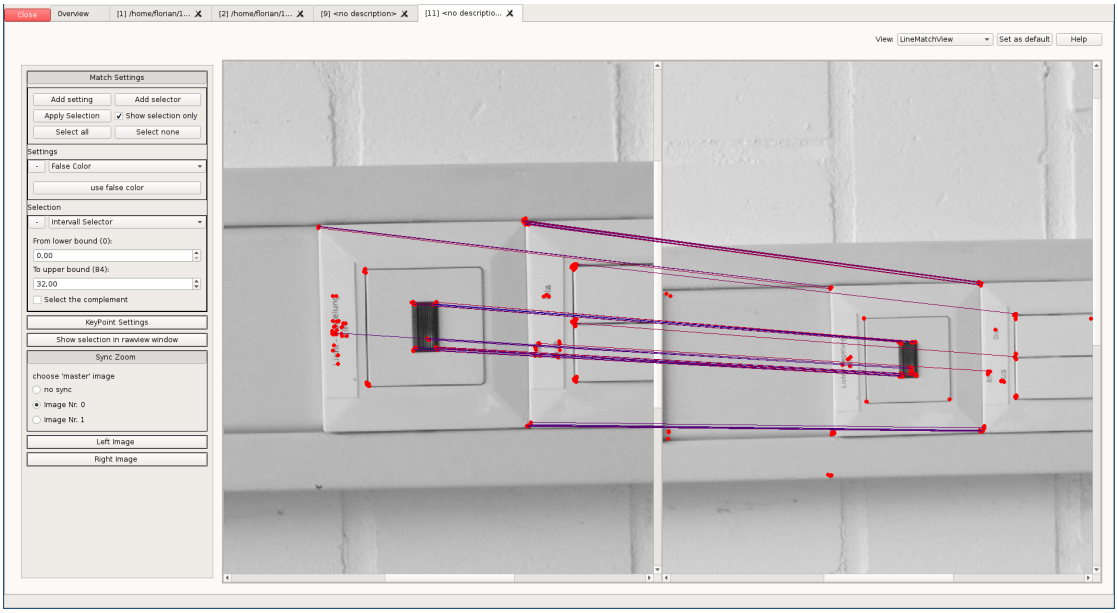
4 GUI-Demo

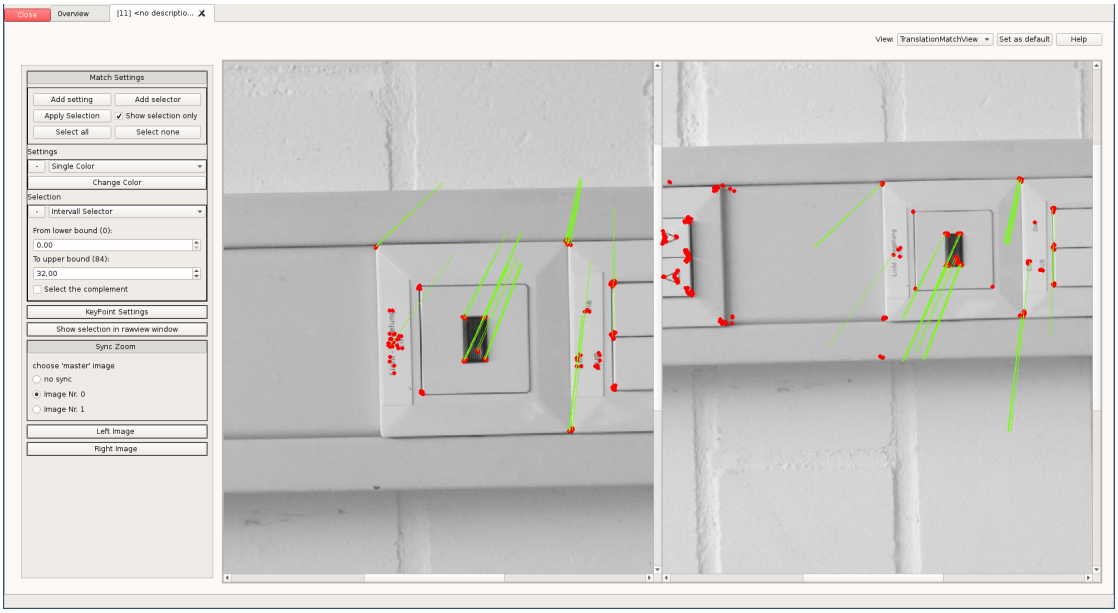
5 Architektur

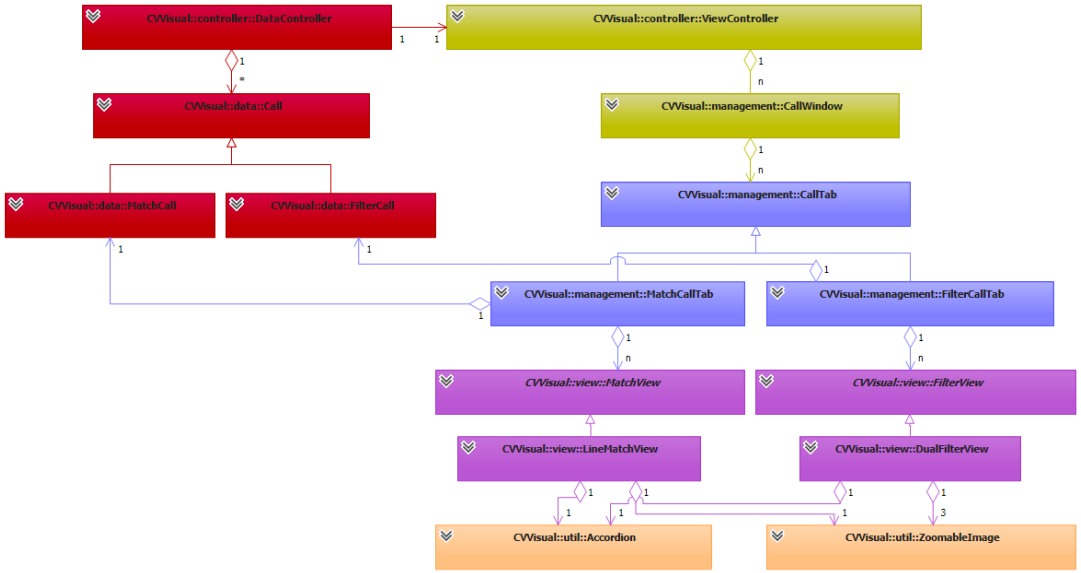
5.1 Entwurf

5.2 Signals/Slots & Templates

```
class SlotQString : public QObject
{   Q_OBJECT
public:
    SlotQString(const std::function<void(QString)> &f,QObject *parent = nullptr)
        : QObject{ parent },function_{f}
```


Close
Overview
[1] /home/florian/1...
[2] /home/florian/1...
[9] <no description>
[11] <no descriptio...
View: LineMatchView
Set as default
Help
Match Settings
Add setting
Add selector
Apply Selection
Show selection only
Select all
Select none
Settings
False Color
use false color
Selection
Intervall Selector
From lower bound (0):
0,00
To upper bound (84):
32,00
Select the complement
KeyPoint Settings
Show selection in rawview window
Sync Zoom
choose 'master' image
no sync
Image Nr. 0
Image Nr. 1
Left Image
Right Image


Close
Overview
[11] <no descriptio...
View: TranslationMatchView
Set as default
Help
Match Settings
Add setting
Add selector
Apply Selection
Show selection only
Select all
Select none
Settings
Single Color
Change Color
Selection
Intervall Selector
From lower bound (0):
0,00
To upper bound (84):
32,00
Select the complement
KeyPoint Settings
Show selection in rawview window
Sync Zoom
choose 'master' image
no sync
Image Nr. 0
Image Nr. 1
Left Image
Right Image




```
    {   if (!f)
            throw std::invalid_argument{ "invalide function" };
    }
public slots:
    void slot(QString t) const
        {function_(t);}
    private:
    std::function<void(QString)> function_;
};
```

5.3 RegisterHelper

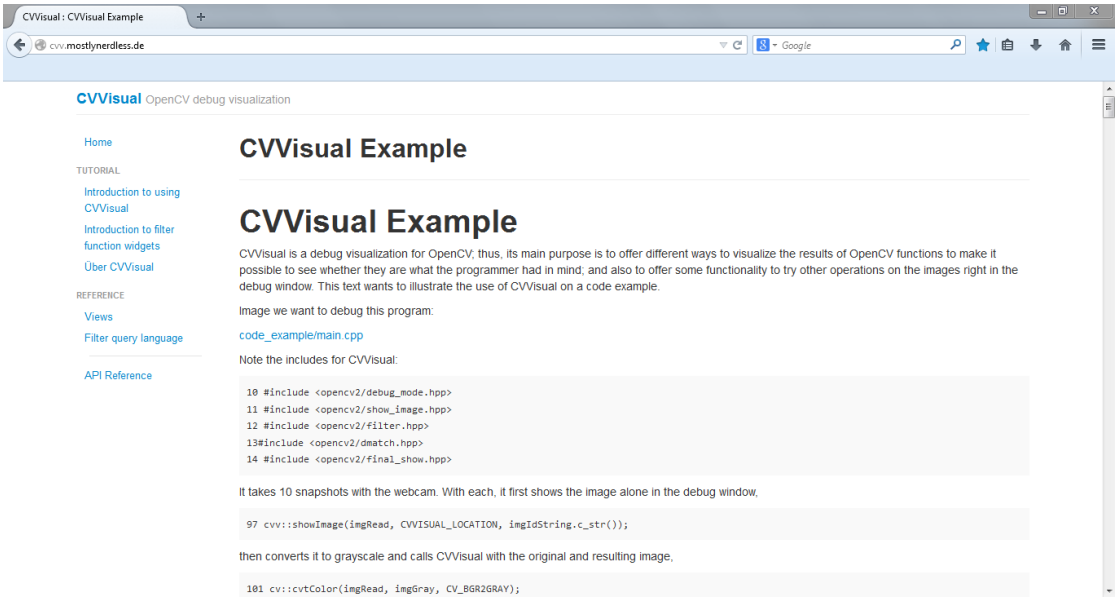
- Ermöglicht die Auswahl von Funktionen über eine Combobox
- Funktionen werden über eine API Funktione registriert
- Wird in der API Demo vorgestellt

```
cvv::qtutil::registerMatchSettings<cvv::qtutil::SingleColorMatchPen>("Single Color");

template <class Setting>
bool registerMatchSettings(const QString &name)
{
    return MatchSettingsSelector::registerElement(
        name, [](std::vector<cv::DMatch> univers)
    {
            return std::unique_ptr<MatchSettings>{ new Setting{univers}};
```

```
    });
}
```

6 Dokumentation

6.1 Tutorials, Beispiele



6.2 Kurzdokumentation

Wird von der Hilfefunktion des Programms benutzt.

6.3 Referenz:

- Mit Hilfe von Doxygen

7 API

7.1 Anwender API

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

CVVisual OpenCV debug visualization

Home

TUTORIAL

Introduction to using CVVisual

Introduction to filter function widgets

Über CVVisual

REFERENCE

Views

Filter query language

API Reference

Views

General information:

Most views offer an `ImageInformation` collapsable in their accordion menus.
The zoom can be found here.
`Ctrl` + `Mouse wheel` is also zoom; `Ctrl` + `Shift` + `Mouse wheel` is a slower zoom.
If the zoom is deeper than 60%, the image's pixels will be overlaid with their channel values; usually, the order is BGR[+alpha] from the top.

Single Image View:

Associated with the `debugSingleImage()` function.
Shows one single image with no features other than `Image Information`.

Filter Views:

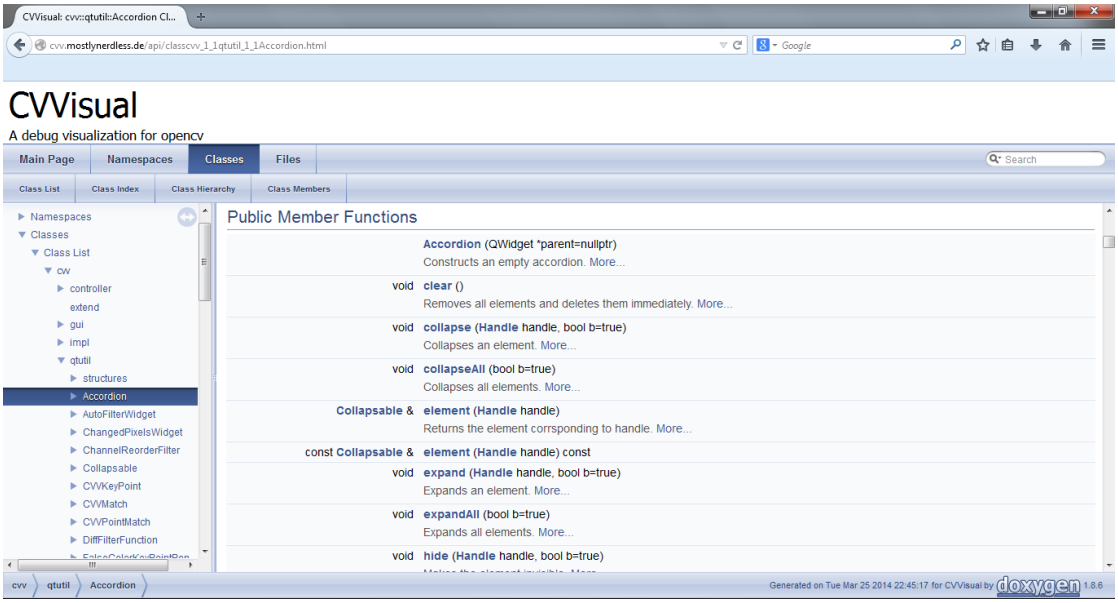
Associated with the `debugFilter()` function.

DefaultFilterView:

Shows two images with only the basic features of `ImageInformation`, synchronized zoom and `Histogram`.

DualFilterView:

Shows the two images given to the CVVisual function and *Result Image* inbetween which represents the result of a filter that was applied to the others via the `Filter selection` collapsable, like a difference image between the two.



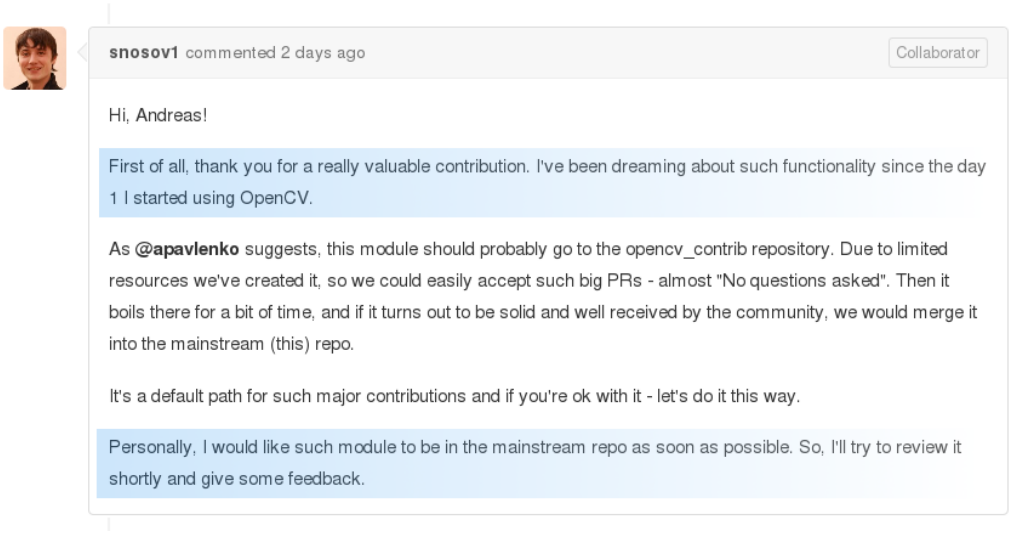
7.2 Interne API

- 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



8.2 Rezeption

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

8.3 Links

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

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.