



Requirements and Analysis Document for G19

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This version overrides all previous versions.

1 Introduction

Are you in need of a new profile picture? Do you sometimes wish your photos would look just a little bit different? Most young people take photos on a daily basis. Making these photos look the way you want them to often takes some skill and experience and can easily become a time-consuming process. Layers is made for quick and simple editing. No time should be wasted on understanding how a complicated program works. Filters and text can be added, sharpen or blur. With all the basic tools close at hand you can give your photos the look you want.

1.2 Definitions, acronyms and abbreviations

- **Center stage** - main visual focus of the GUI
 - **Class** - a Java container used as a template for creating objects
 - **Filter** - a type of image transformation adjusting pixels slightly
 - **GUI** - graphical user interface
 - **int** - an integer value containing whole numbers
 - **Java** - a platform independent programming language
 - **Kernel** - a matrix of values containing weights for a group of pixels
 - **Layer stack** - list containing all the layers applied on the image
 - **Layer** - saved filters/color/text transformation for easy control and access
 - **Object** - a Java term used to describe a defined amount of stored data
 - **Pixel** - a point of light which contains the component colors of the final color
 - **RGB** - Red Green Blue, stands for the component colors of a color which can represent
-

2 Requirements

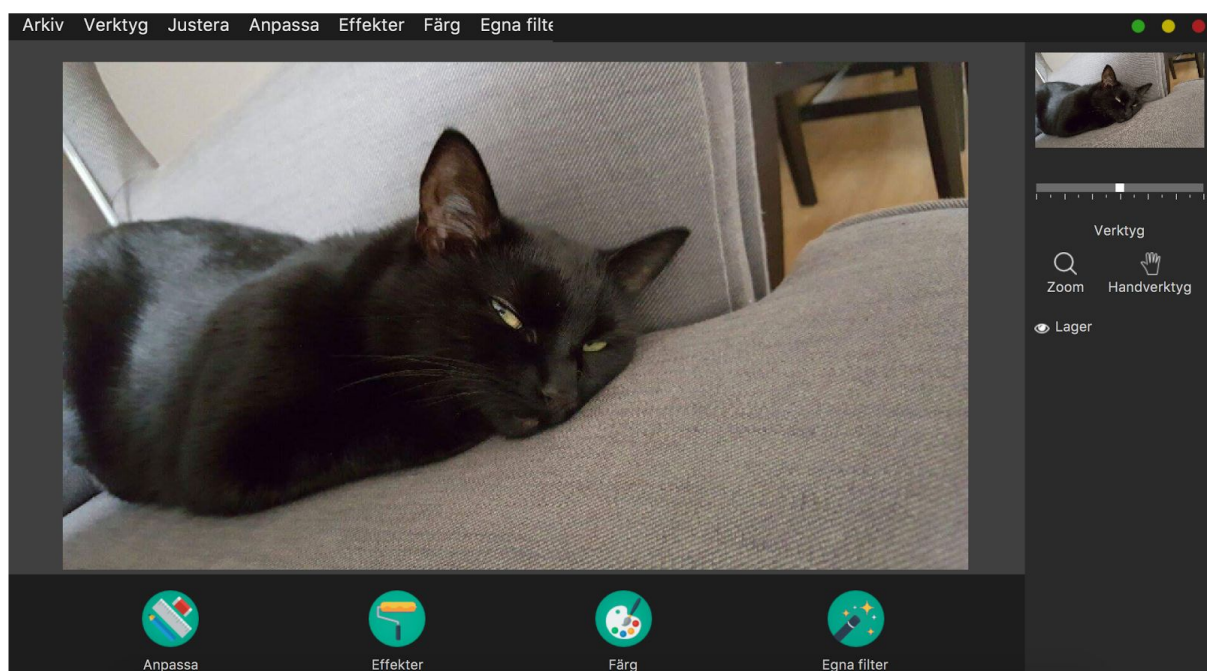
2.1 User interface

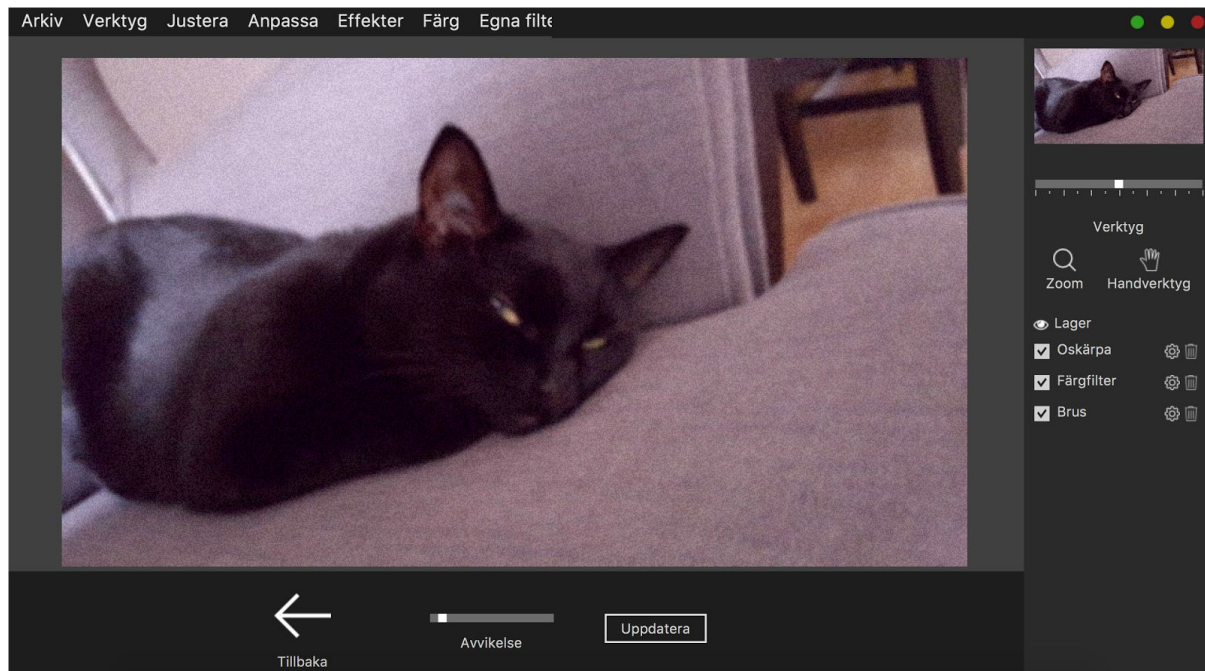
The GUI of Layers is simple. The main view uses the design pattern *Canvas plus Palette* which consists of a large center stage accompanied by a palette at the bottom of the screen with options for editing the photo in question. The palette, or the toolbar, is a simple and easy way to find the function you want to use. When a category is chosen, the options in that category are shown. When an option is picked by the user, the specific settings for that option is shown in the toolbar instead of the different options.

The panel on the right side of the center stage helps the user get an overview of the photo as well as providing a simple way to zoom in and out. It also provides a list of all the layers and all the options related to their visibility and existence.

At the top of the screen all options can be reached through a menu. It can be used for getting an overview of the different options or as a quicker way of finding precisely what the user is looking for.

The interface does not consist of many different pages to navigate between. Instead everything can be reached from the main page. This is to provide a less confusing experience for the user and keep the focus on the photo that is being edited. Therefore, no other view than the main view is needed.





2.2 Functional requirements

General functionality:

- Open photo - allows user to open a photo from computer
- Open project - allows user to open a previous project
- Save project - save project for future modifications
- Export photo - export edited photo to .jpg
- Close program - close the program
- Undo - undo most recent change
- Redo - redo change that has been undone
- Reset photo - remove all layers

Crop, rotate and flip:

- Crop - remove parts of the photo
- Flip vertically - flip the photo around the vertical axis
- Flip horizontally - flip the photo around the horizontal axis
- Rotate 90° right - rotate photo 90° to the right
- Rotate 90° left - rotate photo 90° to the left

Navigation tools:

- Zoom in - view the photo bigger
- Zoom out - view the photo smaller
- The user drags the photo in chosen direction to navigate around it.

Filters:

- Exposure - change of exposure
- Contrast - change the contrast
- Levels - make colors more muted

Noise - add noise to photo
 Blur - make photo blurry
 Gaussian blur - make photo blurry, but keep the edges less blurry
 Sharpen - sharpen the photo
 Edges - enhance the edges
 Text - add text
 Colorshift - increase a certain color in the photo
 Black and white - make photo black and white
 Grayscale - make photo grayscale
 White balance - change the white balance
 Add own filter - create own filter by filling a kernel with values

2.3 Non-functional requirements

The program is in Swedish and is responsive in the rendering of photos.

3 Use cases

3.1 General functionality

Use case: Open a photo

Priority: High

| # | Actor | System |
|---|----------------------------------|-----------------------------------|
| 1 | The user chooses "Öppna bild" | |
| 2 | | File chooser appears |
| 3 | The user chooses a photo to open | |
| 4 | | The photo appears on center stage |

Use case: Open a project

Priority: High

| # | Actor | System |
|---|------------------------------------|--------------------------------------------------------------------------------------|
| 1 | The user chooses "Öppna projekt" | |
| 2 | | File chooser appears |
| 3 | The user chooses a project to open | |
| 4 | | The photo appears on the center stage and the filters used appear in the layer stack |

Use case: Save project

Priority: High

| # | Actor | System |
|---|---------------------------------------------------------------------|--------------------------------------|
| 1 | The user chooses "Spara project" | |
| 2 | | File chooser appears |
| 3 | User chooses a name and location for the project and pushes "Spara" | |
| 4 | | The project is saved in the location |

Use case: Export photo

Priority: High

| # | Actor | System |
|---|--------------------------------------|------------------------------------|
| 1 | The user chooses "Exportera bild" | |
| 2 | | File chooser appears |
| 3 | The user chooses a name and location | |
| 4 | | The photo is saved in the location |

Use case: Close program

Priority: High

| # | Actor | System |
|-------|-----------------------------------|-------------------------------------------------------------------------|
| 1 | The user chooses to close program | |
| 2.1 | | Pop-up asking user if they want to save project or close without saving |
| 2.1.1 | User chooses "Spara" | |
| 2.1.2 | | See use case "Save program" |
| 2.1.3 | | Program is closed |
| 2.2.1 | User chooses "Avsluta" | |
| 2.2.2 | | Program is closed |
| 2.3 | | Program is closed |

Use case: Undo

Priority: Medium

| # | Actor | System |
|---|----------------------|------------------------------------------------|
| 1 | User chooses "Ångra" | |
| 2 | | Latest added layer is removed from layer stack |

Use case: Redo

Priority: Medium

| # | Actor | System |
|---|-----------------------|----------------------------------------|
| 1 | User chooses "Gör om" | |
| 2 | | Removed layer reappears in layer stack |

Use case: Center photo

Priority: Medium

| # | Actor | System |
|---|------------------------------|-----------------------------------|
| 1 | User chooses "Centrera bild" | |
| 2 | | Photo is centered on center stage |

Use case: Center photo

Priority: Medium

| # | Actor | System |
|---|-------------------------------|---------------------------|
| 1 | User chooses "Återställ bild" | |
| 2 | | All the layers is removed |
| 3 | | Canvas is updated |
| 4 | | LayerView is updated |

Use case: Deleting the layer in the layer view

Priority: High

| # | Actor | System |
|---|---------------------------------------|-------------------------------------------|
| 1 | User presses the trash can on a layer | |
| 2 | | System removes the layer from layer stack |
| 3 | | System re-renders the image |

| | | |
|---|--|----------------------------------|
| 4 | | System re-renders the layer view |
|---|--|----------------------------------|

3.2 Crop, rotate and flip

Use case: Crop

Priority: Medium

| # | Actor | System |
|-------|-----------------------------------------------|-------------------------------------------------------------|
| 1 | User chooses "Beskära" | |
| 2 | User drags from one point to another on photo | |
| 3 | | Black square is drawn on photo |
| 4 | | Pop-up "do you only want to keep this part of the picture?" |
| 5.1.1 | User picks "Ja" | |
| 5.1.2 | | Picture is cropped |
| 5.2.1 | User picks "Nej" | |
| 5.2.2 | | Pop-up is closed |

Use case: Flip vertically

Priority: Medium

| # | Actor | System |
|---|---------------------------------|-------------------------------|
| 1 | User chooses "Spegla vertikalt" | |
| 2 | | Picture is flipped vertically |

Use case: Flip horizontally

Priority: Medium

| # | Actor | System |
|---|------------------------------------|---------------------------------|
| 1 | User chooses "Spegla horisontellt" | |
| 2 | | Picture is flipped horizontally |

Use cases: Rotate 90° right

Priority: Medium

| # | Actor | System |
|---|-----------------------------------|--------|
| 1 | User chooses "Roter 90 grader åt" | |

| | | |
|---|--------|-------------------------------------|
| | höger” | |
| 2 | | Picture is rotated 90° to the right |

Use cases: Rotate 90° left

Priority: Medium

| # | Actor | System |
|---|-------------------------------------------|------------------------------------|
| 1 | User chooses “Roter 90 grader åt vänster” | |
| 2 | | Picture is rotated 90° to the left |

3.3 Navigation

Use case: Zoom in

Priority: High

| # | Actor | System |
|---|-------------------------|-----------------------------------------------|
| 1 | User chooses “Zooma in” | |
| 2 | | The photo is repainted in a scaled up version |

Use case: Zoom out

Priority: High

| # | Actor | System |
|---|-------------------------|-------------------------------------------------|
| 1 | User chooses “Zooma ut” | |
| 2 | | The photo is repainted in a scaled down version |

Use case: Zoom by slider

Priority: Medium

| # | Actor | System |
|---|-----------------------------------|--------------------------------------------------------|
| 1 | User changes value in zoom-slider | |
| 2 | | The photo is repainted in a differently scaled version |

Use case: Moving the image on the canvas

Priority: High

| # | Actor | System |
|-----|---------------------------|-----------------------------------------------------------------------|
| 1 | User presses the mouse 1 | |
| 2 | | System stores the coordinates |
| 3 | User moves the mouse | |
| 4 | User releases the mouse 1 | |
| 5 | | System stores the coordinates and calculate the difference in x and y |
| 6 | | System check if the image needs to be moved if it is jump to case |
| 7.1 | | System re renders the image on moved coordinates |
| 7.2 | | System re renders the image as it was |

3.4 Filters

Use case: Blur - toolbar

Priority: Medium

| # | Actor | System |
|---|------------------------------------|---------------------------------------|
| 1 | User chooses "Effekter" in toolbar | |
| 2 | User chooses "Oskärpa" in toolbar | |
| 3 | | Image is blurred |
| 4 | | "Oskärpa" is added to the layer stack |
| 5 | | Settings appear in toolbar |

Use case: Gaussian blur - toolbar

Priority: Medium

| # | Actor | System |
|---|------------------------------------|-------------------------------------------|
| 1 | User chooses "Effekter" in toolbar | |
| 2 | User chooses "Gaussisk oskärpa" | |
| 3 | | Image is blurred but edges are kept sharp |
| 4 | | "Gaussisk oskärpa" is added to the layer |

| | | |
|---|--|----------------------------|
| | | stack |
| 5 | | Settings appear in toolbar |

Use case: Sharpen - toolbar

Priority: Medium

| # | Actor | System |
|---|------------------------------------|--------------------------------------|
| 1 | User chooses "Effekter" in toolbar | |
| 2 | User chooses "Skärpa" | |
| 3 | | The image is sharpened |
| 4 | | "Skärpa" is added to the layer stack |

Use case: Edges - toolbar

Priority: Medium

| # | Actor | System |
|---|-----------------------|--------------------------------------|
| 1 | User chooses "Kanter" | |
| 2 | | Only the edges in the photo is kept |
| 3 | | "Kanter" is added to the layer stack |

Use case: Blur - menu

Priority: Medium

| # | Actor | System |
|---|------------------------|---------------------------------------|
| 1 | User chooses "Oskärpa" | |
| 2 | | Image is blurred |
| 3 | | "Oskärpa" is added to the layer stack |
| 4 | | Settings appear in toolbar |

Use case: Gaussian blur - menu

Priority: Medium

| # | Actor | System |
|---|---------------------------------|------------------------------------------------|
| 1 | User chooses "Gaussisk oskärpa" | |
| 2 | | Image is blurred but edges are kept sharp |
| 3 | | "Gaussisk oskärpa" is added to the layer stack |

| | | |
|---|--|----------------------------|
| 4 | | Settings appear in toolbar |
|---|--|----------------------------|

Use case: Sharpen - menu

Priority: Medium

| # | Actor | System |
|---|-----------------------|--------------------------------------|
| 1 | User chooses "Skärpa" | |
| 2 | | The image is sharpened |
| 3 | | "Skärpa" is added to the layer stack |

Use case: Edges - menu

Priority: Medium

| # | Actor | System |
|---|-----------------------|--------------------------------------|
| 1 | User chooses "Kanter" | |
| 2 | | Only the edges in the photo is kept |
| 3 | | "Kanter" is added to the layer stack |

Use case: Text - toolbar

Priority: Low

| # | Actor | System |
|---|------------------------------------|-------------------------------------------------------------------------------|
| 1 | User chooses "Effekter" in toolbar | |
| 2 | User chooses "Textfilter" | |
| 3 | | Settings appear in toolbar |
| 4 | | "Textfilter" is added to layer stack |
| 5 | | An example text, which you can change via settings, is applied to the picture |

Use case: Colorshift - toolbar

Priority: Medium

| # | Actor | System |
|---|--------------------------------|---------------------------|
| 1 | User chooses "Färg" in toolbar | |
| 2 | User chooses "Färgfilter" | |
| 3 | | Setting appear in toolbar |

| | | |
|---|--|--------------------------------------|
| 4 | | "Färgfilter" is added to layer stack |
| 5 | | Color is applied to picture |

Use case: Black and white - toolbar

Priority: Medium

| # | Actor | System |
|---|--------------------------------|------------------------------------|
| 1 | User chooses "Färg" in toolbar | |
| 2 | User chooses "Svartvit" | |
| 3 | | Settings appear in toolbar |
| 4 | | "Svartvit" is added to layer stack |
| 5 | | The picture turns black and white |

Use case: Grayscale - toolbar

Priority: Medium

| # | Actor | System |
|---|--------------------------------|------------------------------------|
| 1 | User chooses "Färg" in toolbar | |
| 2 | User chooses "Gråskala" | |
| 3 | | "Gråskala" is added to layer stack |
| 4 | | The picture turns grayscale |

Use case: White balance - toolbar

Priority: Medium

| # | Actor | System |
|---|--------------------------------|-------------------------------------|
| 1 | User chooses "Färg" in toolbar | |
| 2 | User chooses "Vitbalans" | |
| 3 | | Setting appear in toolbar |
| 4 | | "Vitbalans" is added to layer stack |

Use case: Add own filter - menu

Priority: Medium

| # | Actor | System |
|---|---------------------------------------|--------|
| 1 | User chooses "Eget filter" in menubar | |

| | | |
|---------|-----------------------------------------|-----------------------------|
| 2 | User chooses "Lägg till eget filter..." | |
| 3 | | New window is opened |
| 4.1.1 | User fills in name and kernel values | |
| 4.1.2.1 | User presses "Spara" | |
| 4.1.2.2 | | Layer is saved |
| 4.1.2.3 | | Layer is applied to picture |
| 4.1.2.4 | | Window is closed |
| 4.1.3.1 | User presses "Verkställ" | |
| 4.1.3.2 | | Layer is applied to picture |
| 4.1.3.3 | | Window is closed |
| 4.1.4.1 | User presses "Avbryt" | |
| 4.1.4.2 | | Window is closed |

Use case: Exposure - toolbar

Priority: Medium

| # | Actor | System |
|---|-----------------------------------|------------------------------------------|
| 1 | User chooses "Anpassa" in toolbar | |
| 2 | User chooses "Exponering" | |
| 3 | | The Exposure of the image changes |
| 4 | | "Exponering" is added to the Layer stack |
| 5 | | Settings appear in toolbar |

Use case: Contrast - toolbar

Priority: Medium

| # | Actor | System |
|---|-----------------------------------|-----------------------------------|
| 1 | User chooses "Anpassa" in toolbar | |
| 2 | User chooses "Kontrast" | |
| 3 | | Setting appear in toolbar |
| 4 | | The contrast of the image changes |

| | | |
|---|--|----------------------------------------|
| 5 | | "Kontrast" is added to the Layer stack |
|---|--|----------------------------------------|

Use case: Levels - toolbar

Priority: Medium

| # | Actor | System |
|---|-----------------------------------|--------------------------------------|
| 1 | User chooses "Anpassa" in toolbar | |
| 2 | User chooses "Nivåer" | |
| 3 | | Setting appear in toolbar |
| 4 | | The levels of the image is changed |
| 5 | | "Nivåer" is added to the layers tack |

Use case: Noise

Priority: Medium

| # | Actor | System |
|---|-----------------------------------|------------------------------------|
| 1 | User chooses "Anpassa" in toolbar | |
| 2 | User chooses "Brus" | |
| 3 | | Setting appear in toolbar |
| 4 | | Noise is added to the image |
| 5 | | "Brus" is added to the layer stack |

Use case: Colorshift - menu

Priority: Medium

| # | Actor | System |
|---|---------------------------|--------------------------------------|
| 1 | User chooses "Färgfilter" | |
| 2 | | Setting appear in toolbar |
| 3 | | "Färgfilter" is added to layer stack |
| 4 | | Color is applied to picture |

Use case: Black and white - menu

Priority: Medium

| # | Actor | System |
|---|-------------------------|--------|
| 1 | User chooses "Svartvit" | |

| | | |
|---|--|------------------------------------|
| 2 | | Setting appear in toolbar |
| 3 | | “Svartvit” is added to layer stack |
| 4 | | The picture turns black and white |

Use case: Grayscale - menu

Priority: Medium

| # | Actor | System |
|---|-------------------------|------------------------------------|
| 1 | User chooses “Gråskala” | |
| 2 | | “Gråskala” is added to layer stack |
| 3 | | The picture turns grayscale |

Use case: White balance - menu

Priority: Medium

| # | Actor | System |
|---|--------------------------|-------------------------------------|
| 1 | User chooses “Vitbalans” | |
| 2 | | Setting appear in toolbar |
| 3 | | “Vitbalans” is added to layer stack |

Use case: Exposure - menu

Priority: Medium

| # | Actor | System |
|---|---------------------------|------------------------------------------|
| 1 | User chooses “Exponering” | |
| 2 | | The Exposure of the image changes |
| 3 | | “Exponering” is added to the Layer stack |
| 4 | | Settings appear in toolbar |

Use case: Contrast - menu

Priority: Medium

| # | Actor | System |
|---|-------------------------|-----------------------------------|
| 1 | User chooses “Kontrast” | |
| 2 | | Setting appear in toolbar |
| 3 | | The contrast of the image changes |

| | | |
|---|--|----------------------------------------|
| 4 | | "Kontrast" is added to the Layer stack |
|---|--|----------------------------------------|

Use case: Levels - menu

Priority: Medium

| # | Actor | System |
|---|-----------------------|--------------------------------------|
| 1 | User chooses "Nivåer" | |
| 2 | | Setting appear in toolbar |
| 3 | | The levels of the image is changed |
| 4 | | "Nivåer" is added to the layers tack |

Use case: Noise - menu

Priority: Medium

| # | Actor | System |
|---|---------------------|------------------------------------|
| 1 | User chooses "Brus" | |
| 2 | | Setting appear in toolbar |
| 3 | | Noise is added to the image |
| 4 | | "Brus" is added to the layer stack |

Use case: Remove Layer

Priority: High

| # | Actor | System |
|---|----------------------------------------|---------------------------------------------------|
| 1 | User Clickes a layer's trashcan symbol | |
| 2 | | The clicked layer is removed from the layer stack |
| 3 | | The canvas is redrawn |
| 4 | | The layerview is updated |

Use case: Hide Layer

Priority: High

| # | Actor | System |
|---|-------------------------------------------|-------------------------------------------|
| 1 | User clicks a layer's visibility-checkbox | |
| 2 | | The visible value is changed on the layer |

| | | |
|---|--|--------------------------|
| 3 | | The canvas is redrawn |
| 4 | | The layerview is updated |

Use case: Show layer

Priority: High

| # | Actor | System |
|---|-------------------------------------------|-------------------------------------------|
| 1 | User clicks a layer's visibility-checkbox | |
| 2 | | The visible value is changed on the layer |
| 3 | | The canvas is redrawn |
| 4 | | The layerview is updated |

Use case: Cursor button clicked

Priority: High

| # | Actor | System |
|-------|-------------------------------|---------------------------------|
| 1 | User clicks the cursor button | |
| 2.1 | | Cursor is not selected |
| 2.1.1 | | The old tool is deselected |
| 2.1.2 | | The cursor is set to do nothing |
| 2.2 | | Cursor is selected |
| 2.2.1 | | Nothing happens |

Use case: Zoom button clicked

Priority: High

| # | Actor | System |
|-------|-----------------------------|-------------------------------------|
| 1 | User clicks the Zoom button | |
| 2.1 | | Zoom is not selected |
| 2.1.1 | | The old tool is deselected |
| 2.1.2 | | The canvas listens for a mouseclick |
| 2.1.3 | User clicks the image | |
| 2.1.4 | | The zoomfactor is changed |

| | | |
|-------|--|-------------------------|
| 2.1.5 | | The canvas is updated |
| 2.1.6 | | The zoomslider is moved |
| 2.2 | | Zoom is selected |
| 2.2.1 | | Nothing happens |

Use case: Crop button clicked

Priority: High

| # | Actor | System |
|-------|-----------------------------|--------------------------------------|
| 1 | User clicks the Zoom button | |
| 2.1 | | Hand is not selected |
| 2.1.1 | | The old tool is deselected |
| 2.1.2 | | The canvas listens for a mouse press |
| 2.1.3 | User presses the mouse | |
| 2.1.4 | | The pont is recorded |
| 2.1.5 | User moves the mouse | |
| 2.1.6 | User releases the mouse | |
| 2.1.7 | | The end point is recorded |
| 2.1.8 | | The image is moved X and Y |
| 2.1.9 | | The image is redrawn |
| 2.2 | | Hand is selected |
| 2.2.1 | | Nothing happens |

Use case: Apply selected Layer

Priority: Medium

| # | Actor | System |
|-----|-------------------------|------------------------------------------|
| 1 | User Choses "Applicera" | |
| 2.1 | | The image turns black |
| 2.2 | | Settings appear in toolbar |
| 2.3 | | "Eget Filter" is added to the layerstack |

| | | |
|-----|---------------------------------------|-----------------------|
| 2.4 | User Selects a filter in the settings | |
| 2.5 | User clicks update | |
| 2.6 | | The layer is updated |
| 2.7 | | The canvas is updated |

Use case: Settings Layer

Priority: Medium

| # | Actor | System |
|-----|----------------------------------|----------------------------------------|
| 1 | User clicks the layers gear icon | |
| 2.1 | | Settings appear in toolbar |
| 2.2 | User changes settings | |
| 2.3 | User clicks the update button | |
| 2.4 | | The layer is updated with the settings |
| 2.5 | | The canvas is updated |

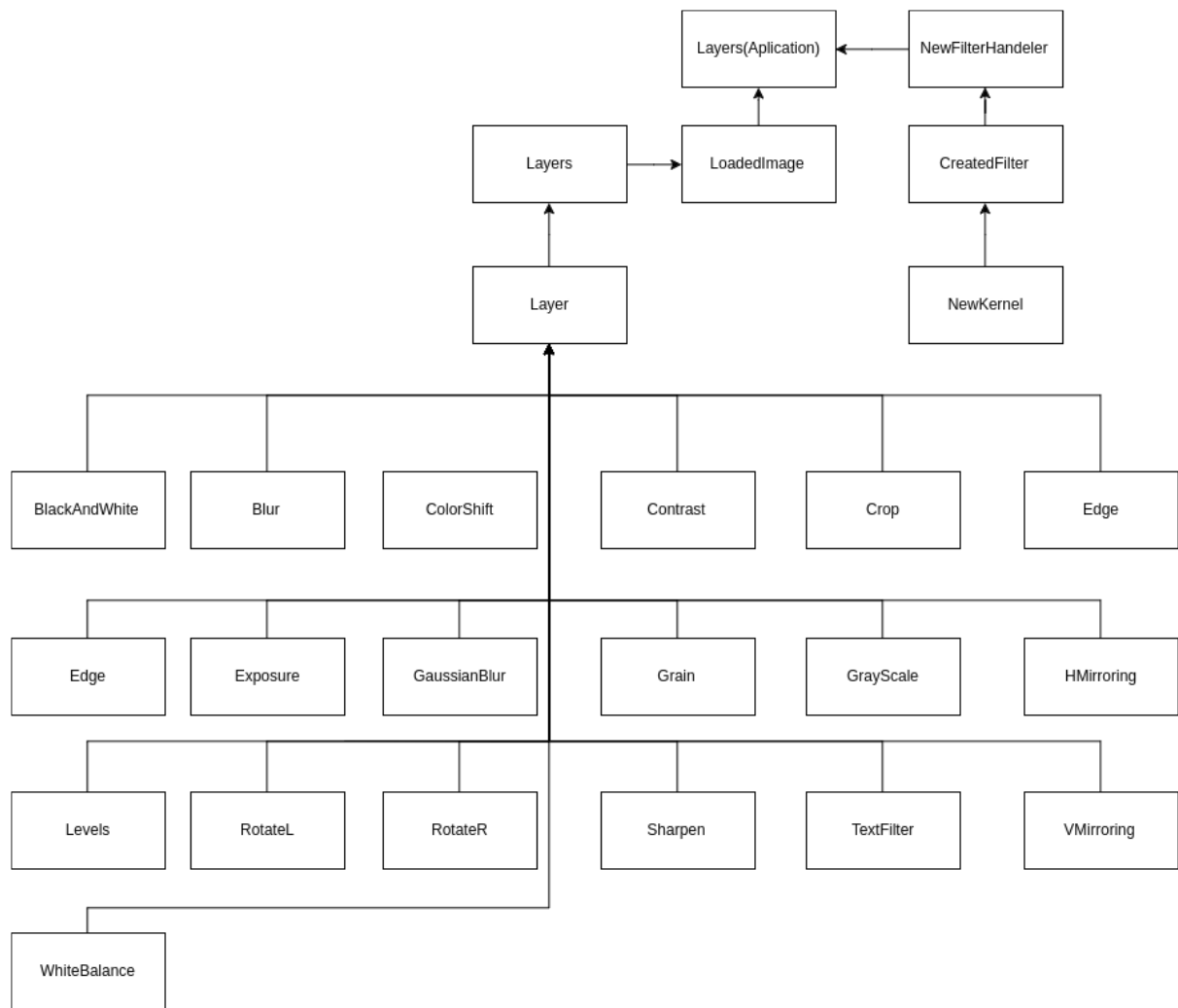
Use case: About

Priority: Medium

| # | Actor | System |
|-----|--------------------------|----------------------------------|
| 1 | User chooses "Om Layers" | |
| 2.1 | | The about Layers window is shown |

4 Domain model

An UML class diagram.



4.1 Class responsibilities

Explanation of responsibilities of classes in diagram:

- **MainView**
The main controller, delegates tasks
- **CanvasView**
Takes care of everything regarding the center stage of the program
- **CropView**
All input regarding the crop function
- **LayerRow**
Custom cell for LayerView
- **LayerView**
List of the added layers
- **MiniCanvasView**
Controls the small version of the image on the right side of the screen
- **NewFilterView**
Handles all input regarding creation of new filters by the user

- CreatedFilter
Puts together the different components in a new layer
- Layer
Keeps information regarding a layer
- Layerable
Interface for all layers
- Layers
Handles the layer stack
- LoadedImage
Keeps the data of the loaded image
- NewFilterHandler
Keep a list of filters created by the user
- OpenProject
Takes care of things related to opening previous saved projects
- SaveProject
Takes care of things related to saving projects
- BlackAndWhite
Filter takes makes each pixel either black or white depending on its value
- Blur
Filter that adds a blur to the image
- ColorShift
Filter that adds a transparent layer of color to the picture
- ColorShiftFactory
Creates a Colorshift
- Contrast
Filter that changes the contrast of the picture
- Crop
All logic behind the crop function
- Edge
Filter that brings out the edges in the picture while toning down the rest
- Exposure
Filter that changes the exposure of the picture
- GaussianBlur
Filter that adds a blur to the picture, while keeping the edges more intact
- Grain
Filter that adds noise to the photo
- Grayscale
Filter that makes the photo grayscale
- HMirroring
Mirrors the image around the horizontal axis
- Levels
Filter that mutes the color of the picture
- NewKernel
Saving and storing new kernels
- RotateL
Rotates the picture 90° to the left

- RotateR
Rotates the picture 90° to the right
- Sharpen
Filter that sharpens the picture
- TextFilter
Adds a text to the picture
- VMirroring
Mirrors the image around the vertical axis
- WhiteBalance
Filter that changes the white balance of the picture