Fuzzy transform in image processing
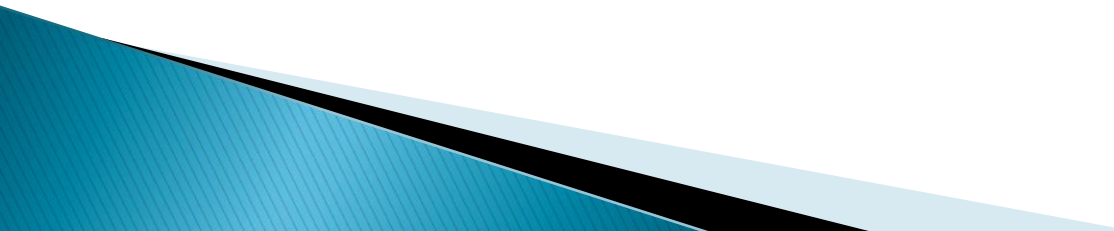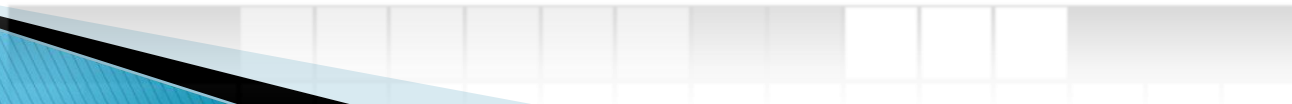
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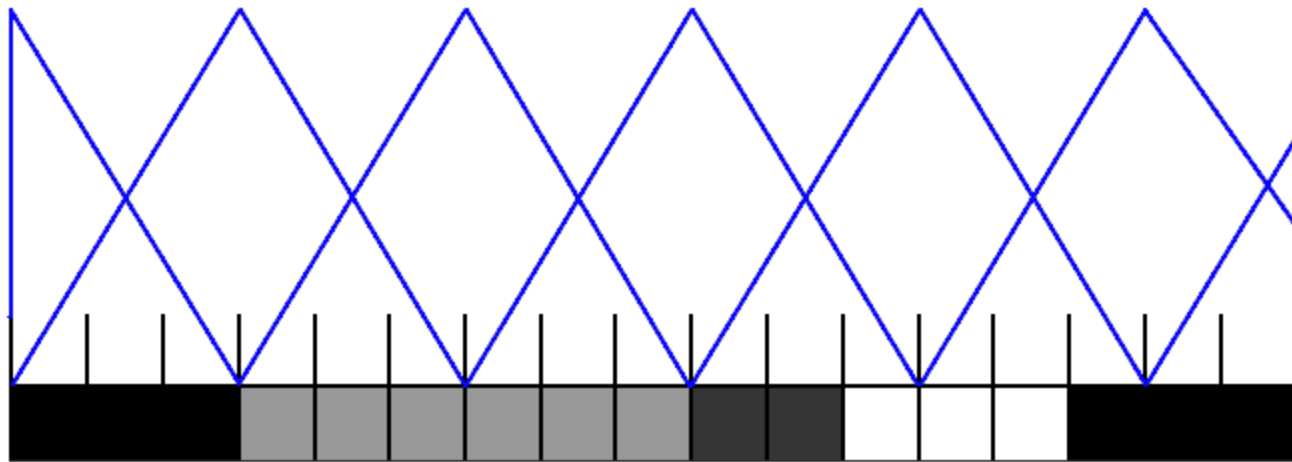
Summary

- Fuzzy transformation
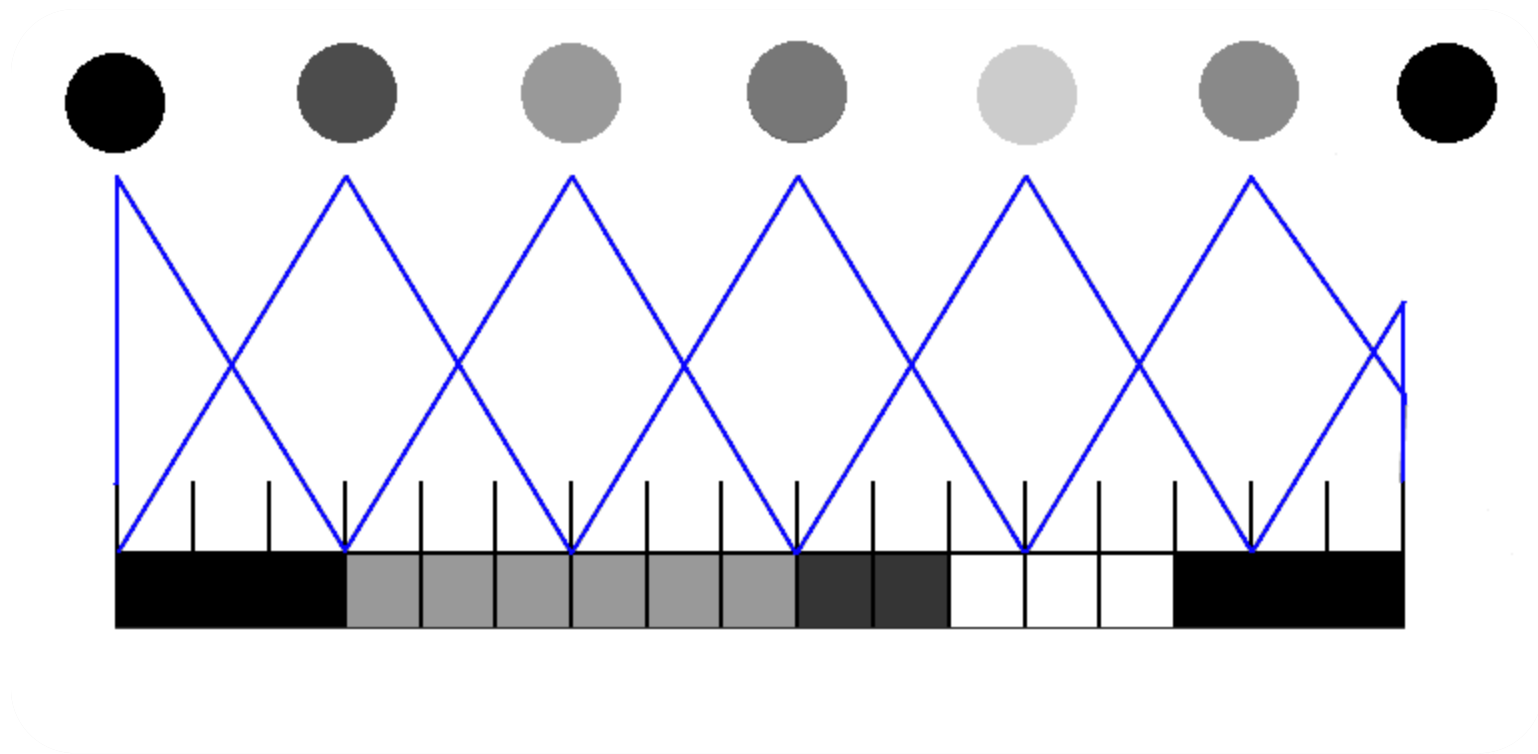
- Image compression

- Image fusion

- Conclusion

Fuzzy transform processing

Fuzzy transform processing

Fuzzy transform processing

Fuzzy transform processing
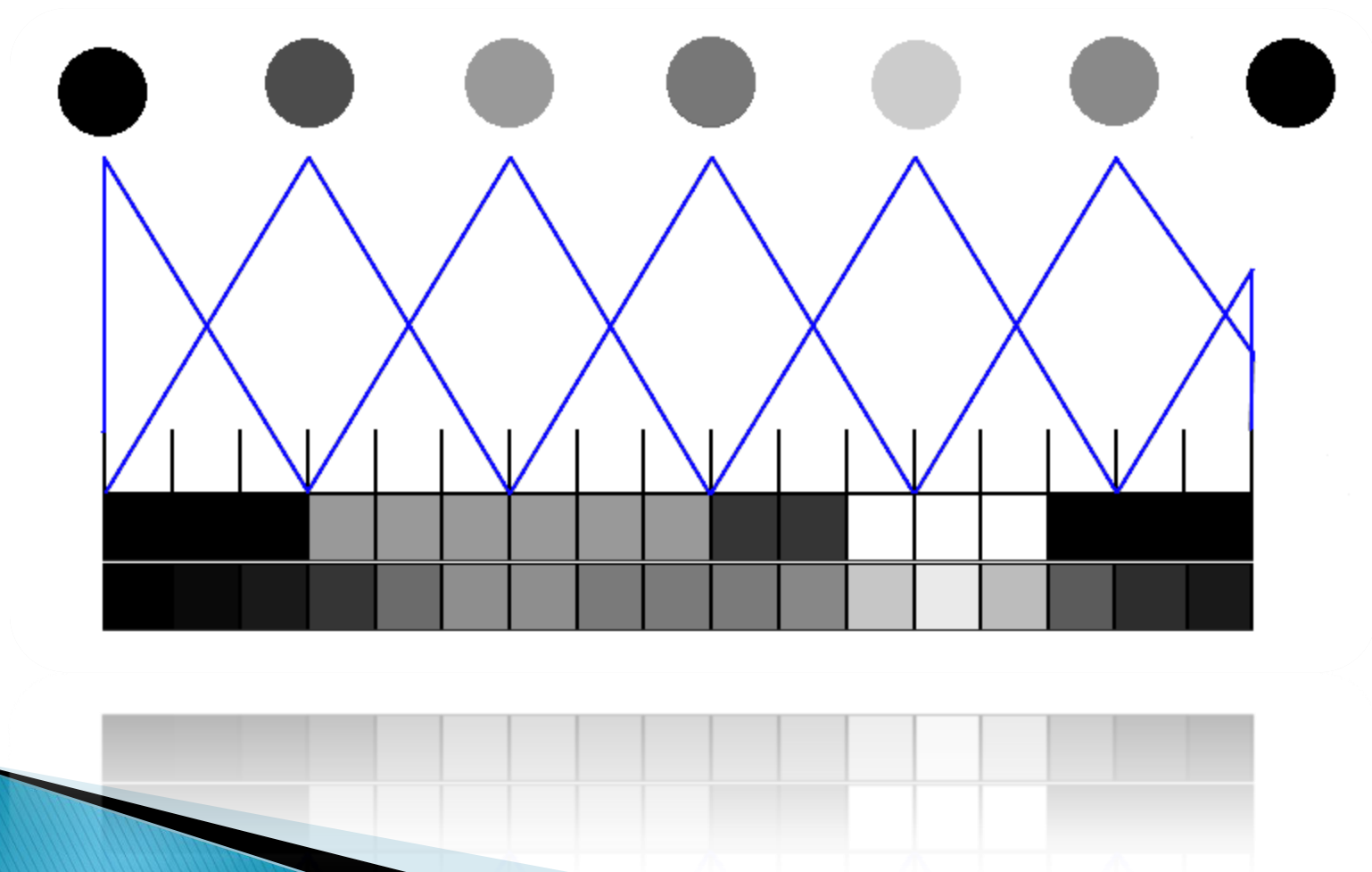
Main method for

- Image compression

- Image fusion

Image compression

Source image
  ➜ Array of pixels / bytes
    ➜ Forward fuzzy transformation
      ➜ Components

Components
  ➜ Inverse fuzzy transformation
    ➜ Array of pixels / bytes
      ➜ Reconstructed image

First results

Original image
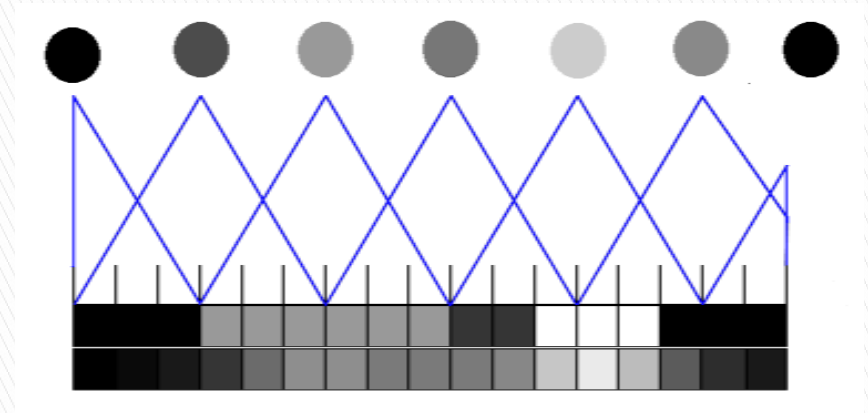
Reconstructed image

Basic transformation

Original image
(3 MB)

Basic transformation
(1 MB)

Basic transformation
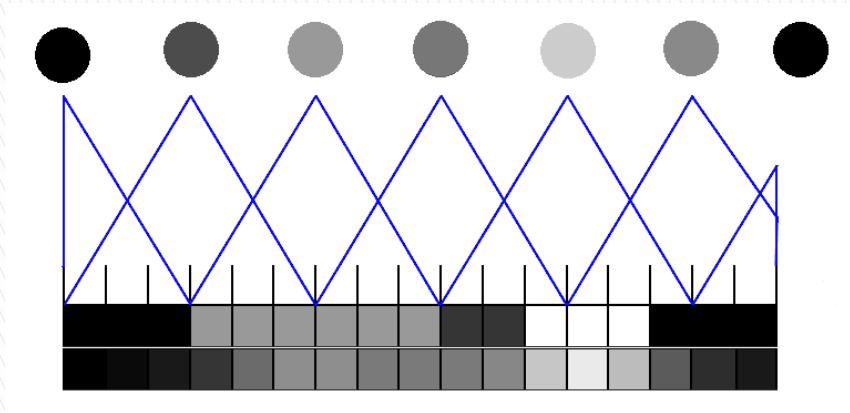

Original image
(3 MB)

Basic transformation
(1 MB)

Improvements

- 2D transformation
- Using split value
  - Lower & upper component
- Source image split
  - Up->Down
- Variable ppb
  - Variable pixel count per image R/G/B component

  - Variable pixel count per image Y/Cb/Cr component

2D transformation

Basic transformation
(1 MB)

2D transformation
(550 kB)

2D transformation

Basic transformation
(1 MB)

2D transformation
(550 kB)

Improvements

- 2D transformation
- Using split value
  - Lower & upper component
- Source image split
  - Up->Down
- Variable ppb
  - Variable pixel count per image R/G/B component

  - Variable pixel count per image Y/Cb/Cr component

Use split value

Original image
(3 MB)

Using split value
(1,17 MB)

Use split value

Original image
(3 MB)

Using split value
(1,17 MB)

Improvements

- 2D transformation
- Using split value
  - Lower & upper component
- Source image split
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  - Variable pixel count per image Y/Cb/Cr component

Source image split

Original image
(3 MB)

Source image split
(1,13 MB)

Source image split

Original image
(3 MB)

Source image split
(1,13 MB)

Improvements

- 2D transformation
- Using split value
  - Lower & upper component
- Source image split
  - Up->Down
- Variable ppb
  - Variable pixel count per image R/G/B component

  - Variable pixel count per image Y/Cb/Cr component

Variable ppb / RGB

Original image
(3 MB)

Variable ppb RGB8
(740 kB)

Variable ppb / RGB

Original image
(3 MB)

Variable ppb RGB8
(740 kB)

Improvements

- 2D transformation
- Using split value
  - Lower & upper component
- Source image split
  - Up->Down
- Variable ppb
  - Variable pixel count per image R/G/B component

  - Variable pixel count per image Y/Cb/Cr component

Variable ppb / YCbCr

Original image
(3 MB)

Variable ppb / YCb3Cr20
(430 kB)

Variable ppb / YCbCr

Original image
(3 MB)

Variable ppb / YCb3Cr20
(430 kB)

Future work

- Improve implementation
  - YCrCb together with source image split

- Create file-format
  - And optimalization
    - = compare ability

- Improve algorithm speed

Image fusion

- A set of source images
  - E.g. Photos with different focus

Find sharp parts (the best parts)
→ extract
→ create new image
(better than previous ones)

Image fusion

- **Sharp part extraction problem**
  - Solved via Forward and inverse fuzzy transformation

- **Main idea**

  - Weak point of FT is edge

  - The more fuzzy image
    - The better result after fuzzy transformation

Image fusion

Source images

➔ recursively transform via fuzzy transformation

➔ good parts have high difference between origin and reconstruction

➔ find those high differences

➔ use them to reconstruct sharp image

Example

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AviationCorner.net

Example

Example

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AviationCorner.net

Real example

Real example

Real example

Future work

- Improve performance

- Ghosts in very fuzzy images
  - Adapt the process

- Images does not fit
  - ???

Thank you for your attention…