

NICER

Aesthetic Image Enhancement with Humans in the Loop

Michael Fischer, Konstantin Kobs, and Andreas Hotho

Julius-Maximilians-Universität Würzburg

m.fischer@informatik.uni-wuerzburg.de



Michael Fischer

2014 - 2017: B.Sc. Aerospace Information Technology, JMU Würzburg, Germany.

2018 - 2020: M.Sc. Computer Science, JMU Würzburg, Germany.

Since 2020: Ph.D. Student, University College London, UK.

My research interests include computer graphics, artificial intelligence, machine learning, its intersections with human perception and human-computer interaction.

NICER - Aesthetic Image Enhancement with Humans in the Loop

- Number of images taken increases steadily
- Casual users do neither have time, patience, nor skills to edit all images
→ Automate the enhancement

- There exists automated enhancement software
- Often, enhancement routine is a “black box”
- Users are left with little to no control over the enhancement outcome
→ Let the users influence the enhancement. Incorporate their preferences into the process.

Incorporating user preferences into enhancement...

... implicitly, using a latent style space

...via a pre-enhanced photo
collection

(might not always be given)

...via generative adversarial
networks

**(training data is not
personal)**

...via user clustering

**(large scale approach, not
suitable for individuals)**

... explicitly, by manual
enhancement or time-
consuming setups

(not user friendly)

Incorporating user preferences into enhancement...

... implicitly, using a latent style space

...via a pre-enhanced photo
collection

(might not always be given)

...via generative adversarial
networks

**(training data is not
personal)**

...via user clustering

**(large scale approach, not
suitable for individuals)**

... explicitly, by manual
enhancement or time-
consuming setups

(not user friendly)

... **intelligently**, by
interactively combining user
input and machine
intelligence.

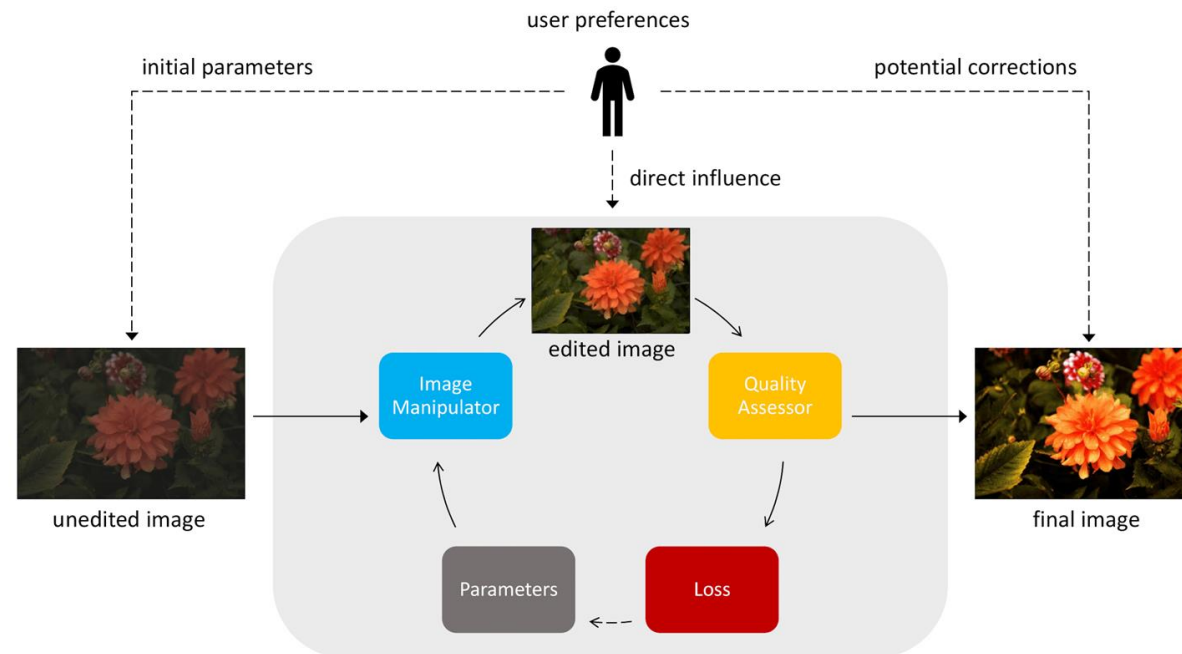
NICER

Two neural networks as main components:

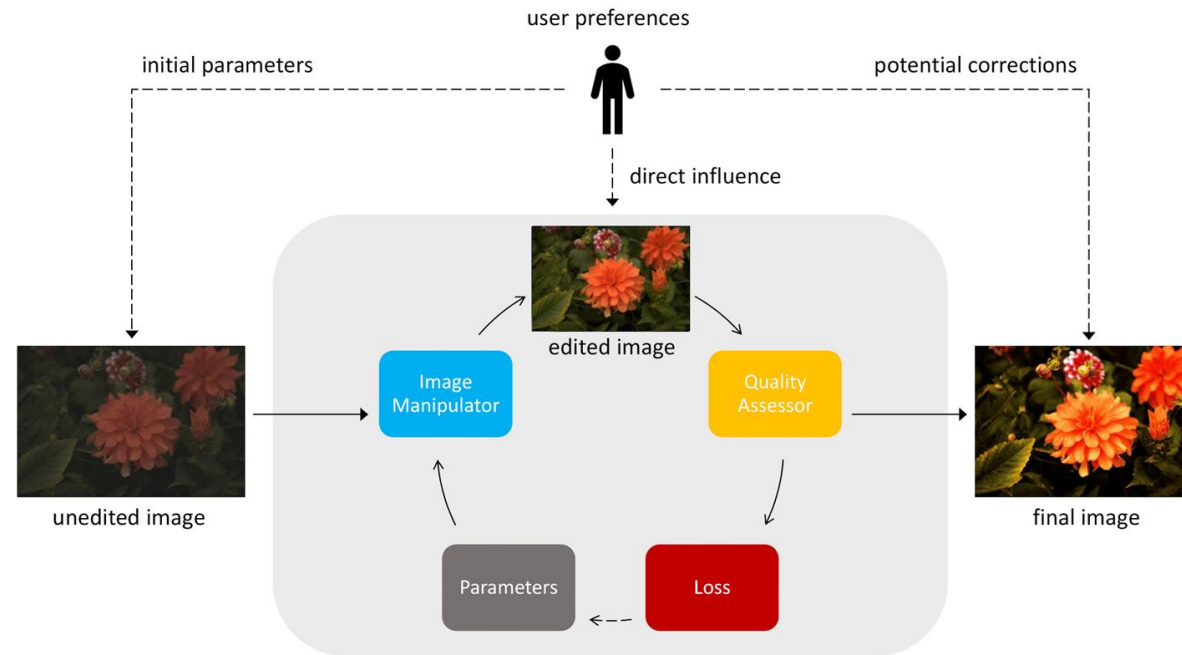
- **Image Manipulator**
 - Context Aggregation Network (CAN)
 - 8 photographic & artistic filters (e.g., brightness, contrast)
- **Quality Assessor**
 - Neural Image Assessment (NIMA)
 - CNN feature extractor, regresses to a “beauty score”
- Iterative optimization loop and perceptual loss allow for interactive back-and-forth:

User influence ...

- **before enhancement:** set initial filter intensities (e.g. high contrast)
- **during enhancement:** control / change filter parameters to guide the next optimization step
- **after enhancement:** outcome is not fixed, parameters can be manipulated further

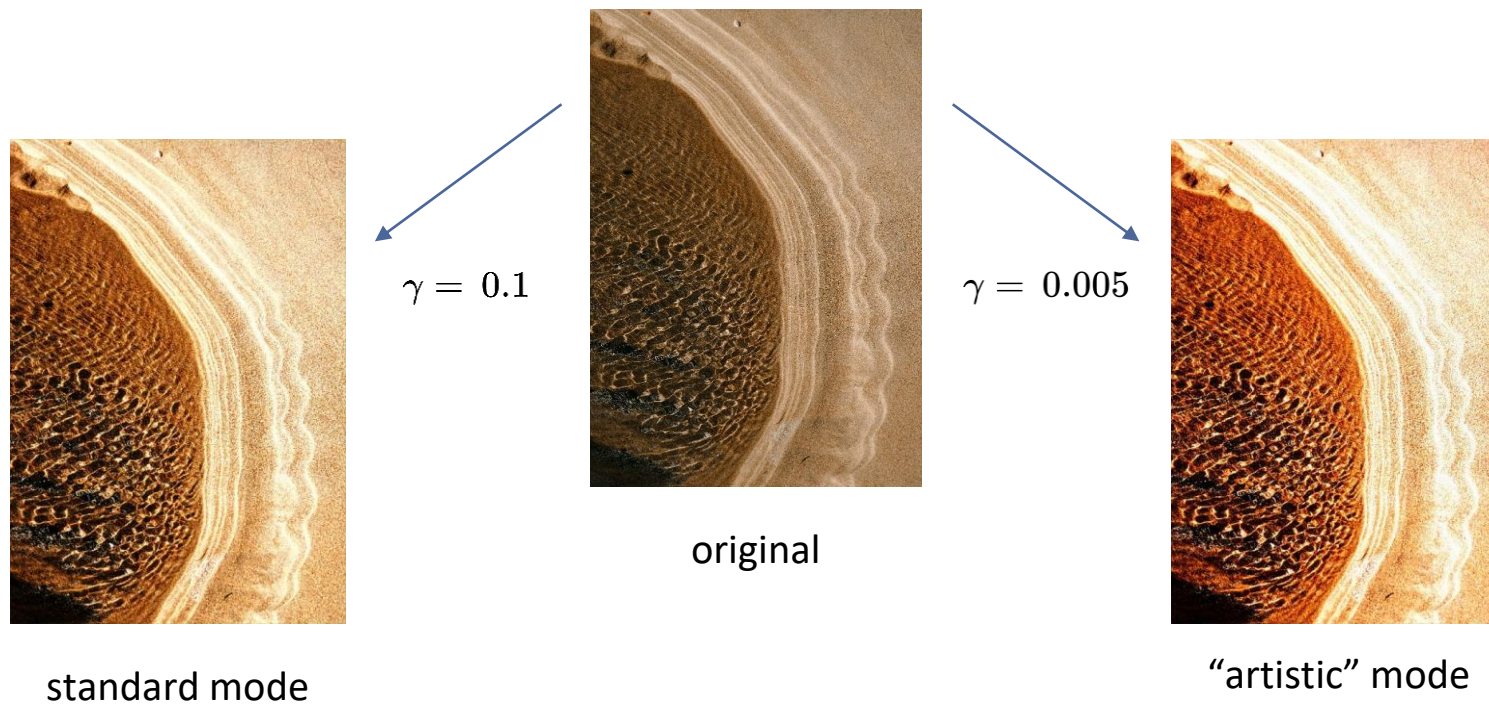


- With the iterative approach, a user can interact with NICER to guide the optimization process
- Without user interaction, NICER enhances the image automatically, but might not exactly match the user's imagined outcome



NICER's automatic enhancement

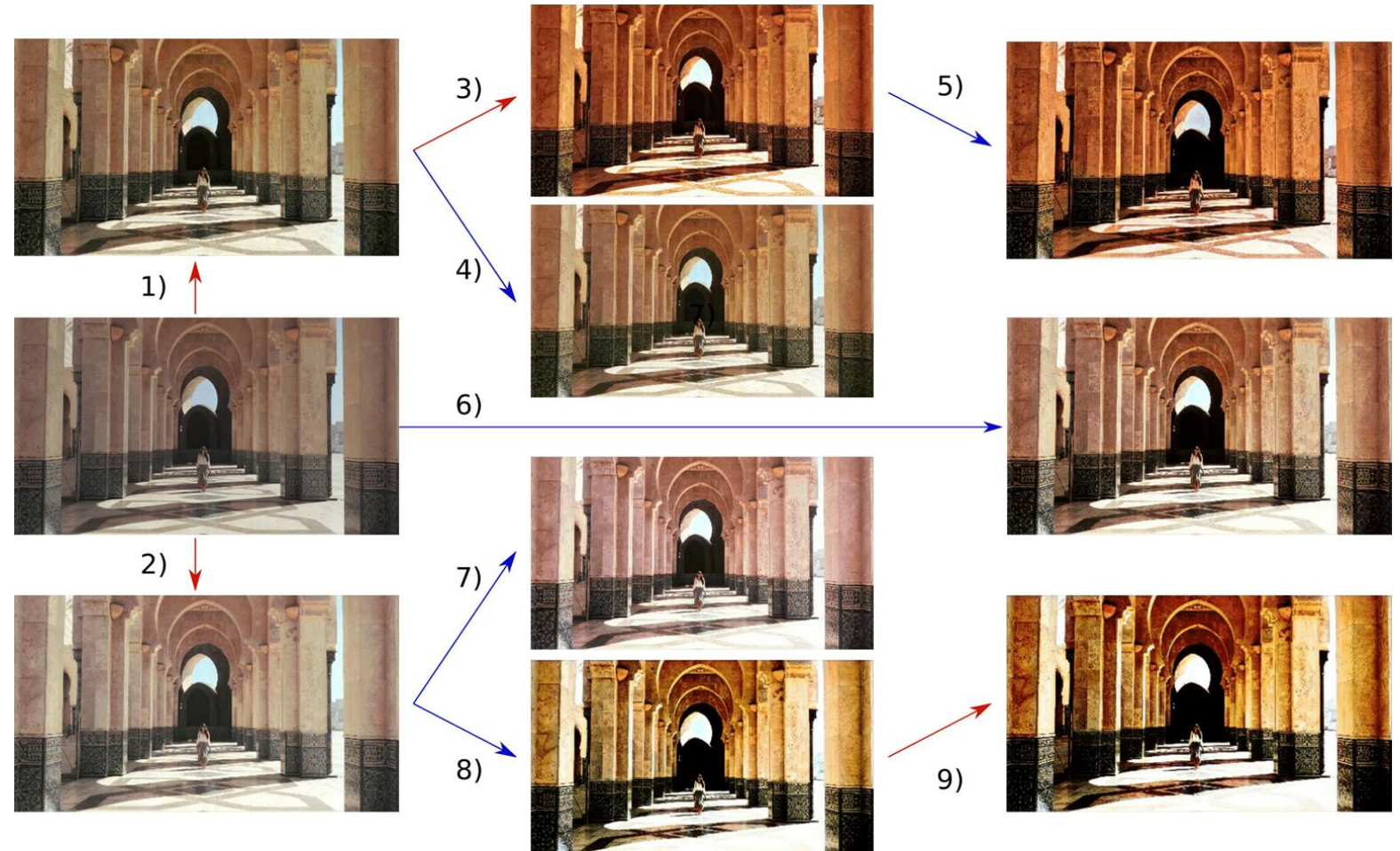
- User study (51 subjects) to compare preferences about different image edits
- Rank NICER's output vs. original image and image edit with random parameters



- For 93% of all images, our participants prefer the enhanced image over the random baseline
- 53.7% of images are preferred over the original, which is a statistically significant change (1% confidence interval)
- High variance in ratings shows that perception of beauty depends heavily on subject
→ Incorporate the user in the enhancement process

NICER's enhancement with humans in the loop

- Letting users choose interaction routes based on their personal likings
- Do users like the output of the interactive enhancement process better?



A sample optimization process where the user (red) interacts with NICER (blue) to create a set of **custom enhancements** that are tailored to their liking.

- 97.9% of our participants: enhancements are better than the original image
- 68.1% of our participants:
prefer enhancement routes that include at least one of NICER's automatic steps

Conclusion:

- combining user interaction with automatic, intelligent enhancement is a valid approach
- further research can be conducted on the influence of different networks and training data on NICER's performance

Our contributions:

- NICER, a novel way of incorporating users' aesthetic preferences into image enhancement
- a publicly available repository, containing our source code and trained models.

Contribution No. 20186 - “NICER - Aesthetic Image Enhancement with Humans in the Loop”

Github Project Page: <https://github.com/mr-Mojo/NICER>

Contact Author: Michael Fischer, m.fischer@informatik.uni-wuerzburg.de