NICER
Aesthetic Image Enhancement with Humans in the Loop

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Contribution No. 20186
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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.
Motivation

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)
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... explicitly, by manual enhancement or time-consuming setups
(not user friendly)

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

NICER
Method: 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:
Method: NICER

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
Method: NICER

- 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.
First Experiment

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

A sample optimization process of NICER’s automatic enhancement mode. The diversity of the automatic mode can be controlled by the factor gamma. In our experiment, we set $\gamma=0.1$. 
First Experiment: Results

• 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
Second Experiment

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.
Second Experiment: Results

• 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

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