Predicted Local Quality as a Resource Allocation Scheme in Variable Image Compression

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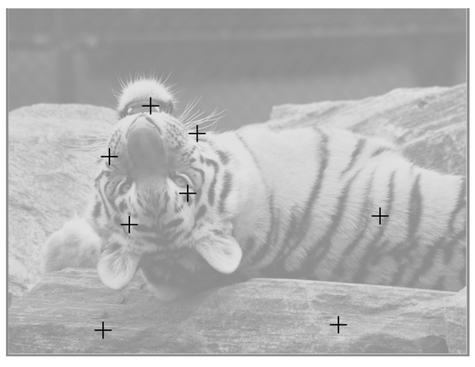
a) Input Image

b) Patchnet Quality Map

c) Pruned Quality Map



d) Centroid Locations

e) Gaussian Approximation

Motivation

Enhance image compression using a non-uniform bit allocation scheme.

Previous Work and Challenges

Avg. 10% bitrate improvement in [1]

- Eye-tracking based
- Slow, expensive, impracticable

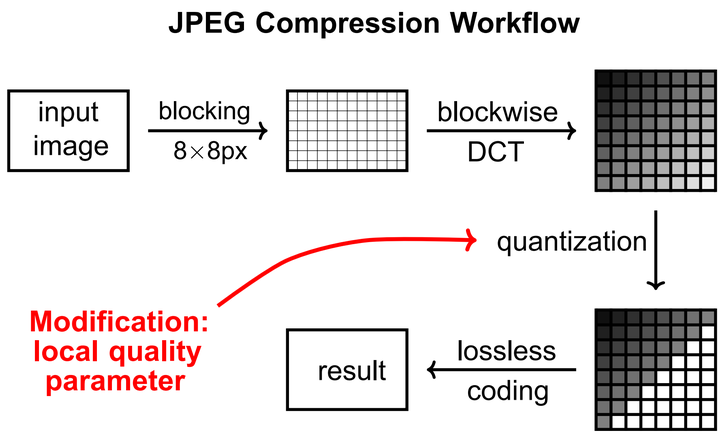
Goal: Detect & preserve HQ regions

Patchnet

- Takes 64×64 pixel patches
- Emits a local quality score in $[0, 1]$
- Trained on 32.000 annotated examples

$\Rightarrow$ Use predictions to steer local bitrate

Variable DCT Block Quantization

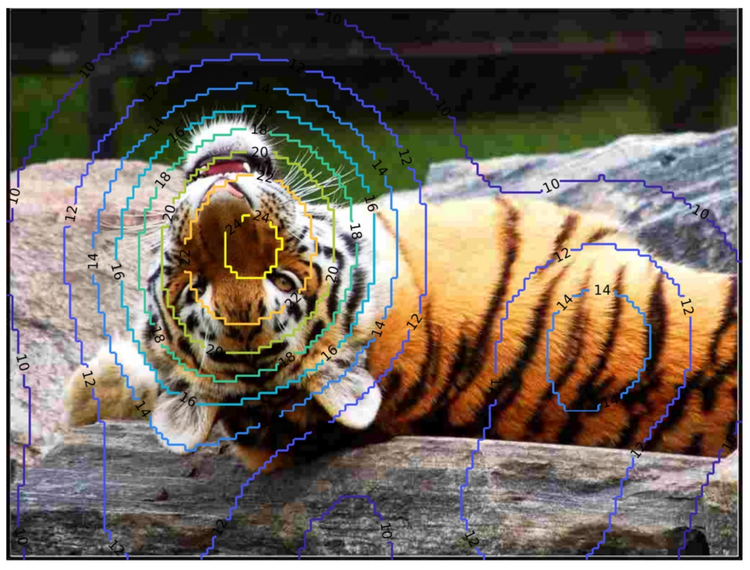


$$q_b = round(q_{\text{min}} + \Delta mean(M|_b))$$

where

- q_{min} is a global quality minimum parameter
- Δ is the maximal quality difference
- $M|_b$ is the corresponding predicted quality map

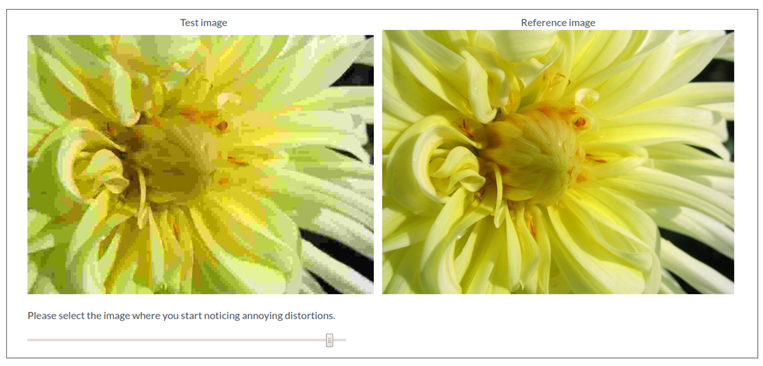
Early Results



VarJPEG quality contours

Anchoring image quality at the point of the JND:

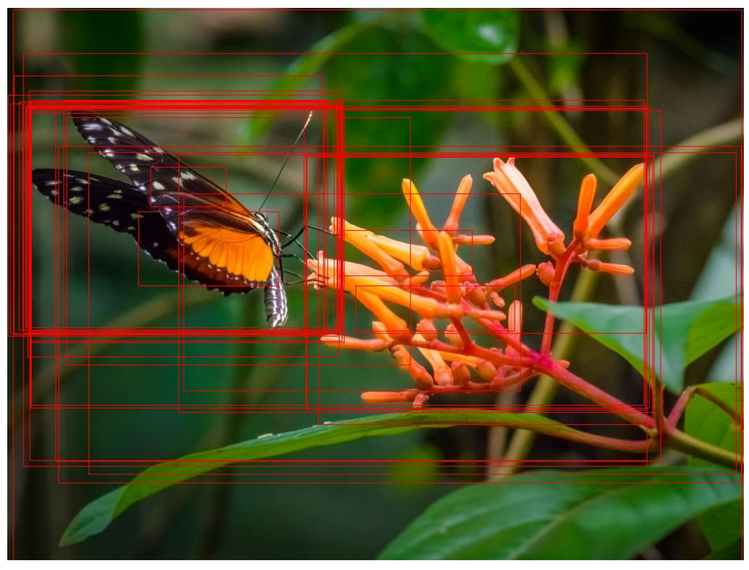
- 125 reference images from KonIQ-10k
- For each, create 100 compressed derivatives
  - Using standard *and* VarJPEG
  - Pairwise matching bitrates
- Crowd study with 15 observers per image



Slider-based JND experiment

- **JND: 75% of the observers notice a difference**
- VarJPEG performs best at high bitrates
- Challenges:
  - Temporal flickering effects in the study
  - Overhead at low bitrates
  - Blocking artifacts

Supplementary Study



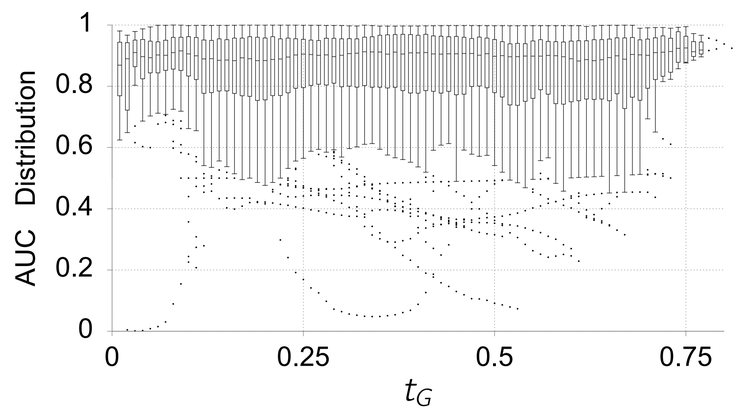
Boxing tool selections marking perceptual HQ areas

Crowdsourcing:

- The same 125 images from KonIQ-10k
- 30 participants

$$q_{i,j} = \frac{\#\text{bounding boxes including } \mathcal{I}_{i,j}}{\#\text{participants}}$$

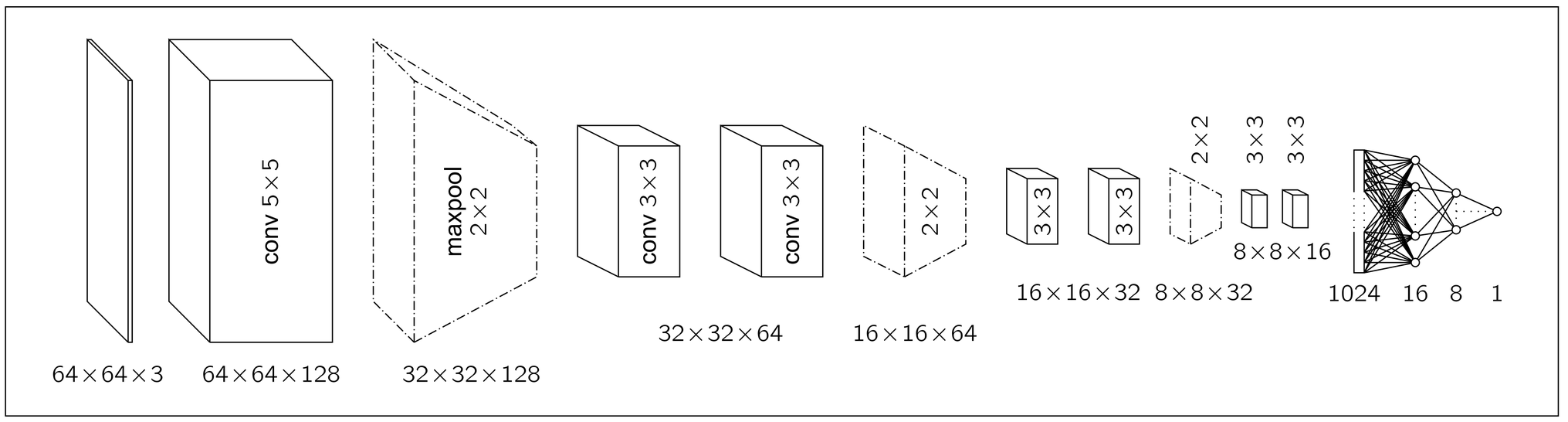
Statistical Performance Analysis



References

[1] V. Hosu, F. Hahn, O. Wiedemann, S.-H. Jung and D. Saupe. Saliency-Driven Image Coding Improves Overall Perceived JPEG Quality. Picture Coding Symposium, IEEE, 2016.

[2] O. Wiedemann, V. Hosu, H. Lin and D. Saupe. Disregarding the Big Picture: Towards Local Image Quality Assessment. 10th International Conference On Quality of Multimedia Experience, IEEE 2018.



Architecture of Patchnet

SFB-TRR 161
Quantitative Methods for Visual Computing

Project A05, Image/Video Quality Assessment
Universität Konstanz
`databases.mmsp-kn.de`

VQA