A Comparative Study for Single Image Blind Deblurring

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Single Image Blind Deblurring

- **Algorithms:**
  - Fergus et al. 2006
  - Shan et al. 2008
  - Cho & Lee 2009
  - Krishnan et al. 2011
  - Whyte et al. 2011
  - Hirsch et al. 2011
  - Xu et al. 2013
  - Zhong et al. 2013
  - Sun et al. 2013
  - Michaeli et al. 2014
  - Pan et al. 2014
  - Perrone et al. 2014
  - Levin et al. 2009
  - Kohler et al. 2012
  - Sun et al. 2013

- **Datasets:**
  - Depth variation
  - Camera response functions
  - Saturation
  - Compression artifacts

- **Real images:**
  - Depth variation
  - Camera response functions
  - Saturation
  - Compression artifacts
Our Goal

• Performance evaluation on *real-world blurred images*
  – a dataset of real images
  – large scale comparative study
User-Study

• Evaluate on 14 methods, 100 images
  – $\binom{14}{2} = 910$ comparisons per image
  – collect about 100k paired comparisons from 2000 subjects
From Paired Comparisons to Full Ranking

• Fit votes to the Bradley-Terry Model (B-T Model)
  – $M_{ij}$ = #times that users choose method $i$ over method $j$
  – $S_i$ = the B-T score of method $i$

\[
\begin{align*}
M_{12} & = 101 \\
M_{13} & = 80 \\
... & \\
M_{45} & = 25
\end{align*}
\]

\[
\begin{align*}
S_1 & = 3.14 \\
S_2 & = 1.59 \\
... & \\
S_5 & = 2.65
\end{align*}
\]
Comparing Real and Synthetic Datasets

![Graphs showing comparison between real and synthetic datasets with different synthetic distributions.](image-url)
Comparing Image Quality Metrics

![Bar chart showing correlation for full-reference metrics and no-reference metrics.](image)

- **Full-reference metrics**
  - PSNR
  - SSIM
  - IFC
  - VIF

- **No-reference metrics**
  - BIQI
  - CORNIA
  - DIIVINE
  - Liu et al.
Observations

- **Image priors**: sparse priors are more robust than edge prediction methods \( \frac{\|\nabla x\|_1}{\|\nabla x\|_2} , \|x\|_0 > \)

- **Image formations**:

- **Datasets**: performance on synthetic datasets does not reflect the performance on real images

- **Quality metrics**: IFC/VIF > PSNR/SSIM; none of no-reference metrics are applicable
Conclusions

• First large scale comparative study on real-world images
  – quantitatively evaluate the progress of the field
  – identify potential research directions

• Code, datasets and results are available: bit.ly/deblur_study

• Poster #22