Probabilistic Image Models

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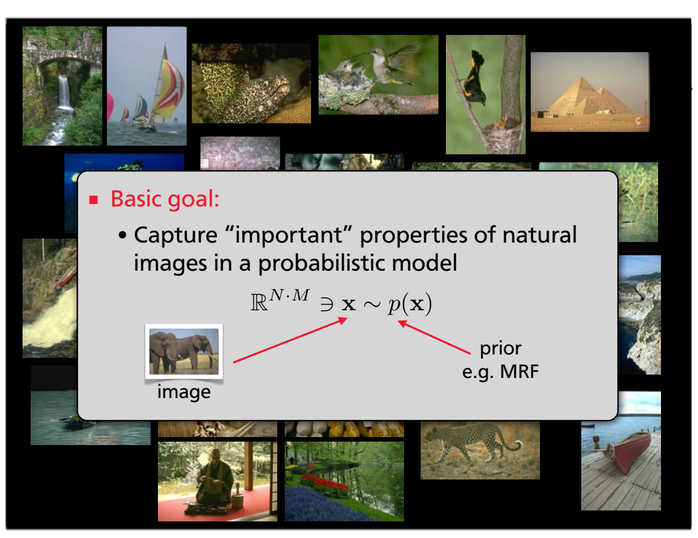
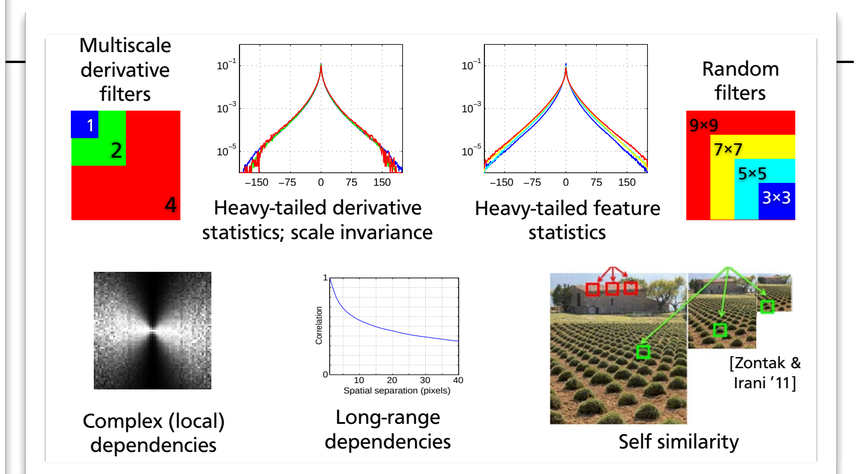
Challenge

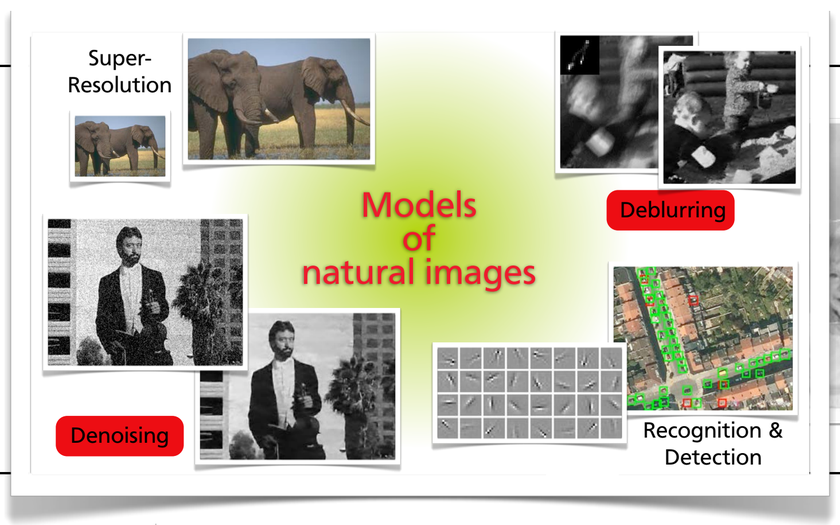
- Devise probabilistic models of natural images
- Want to encode (statistical) prior knowledge about images

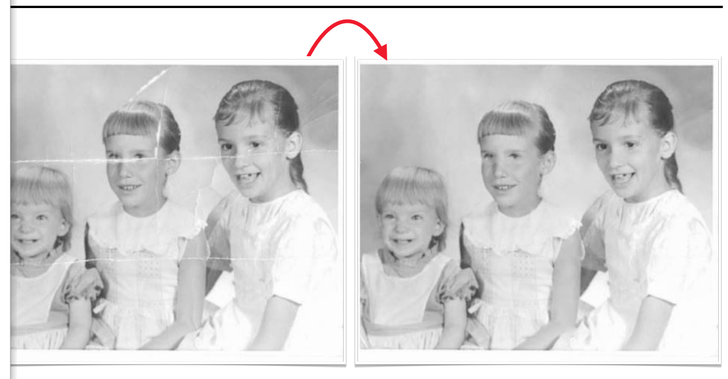




Applications

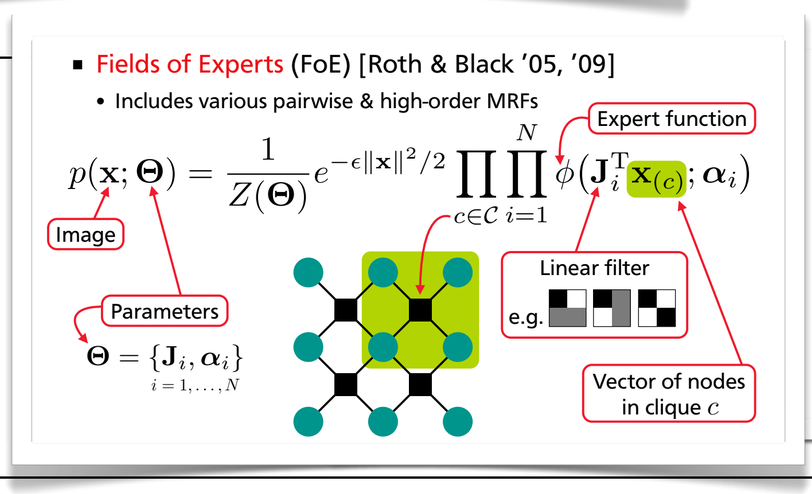
- Image restoration, e.g. denoising, deblurring, super-resolution, etc.
- Feature extraction

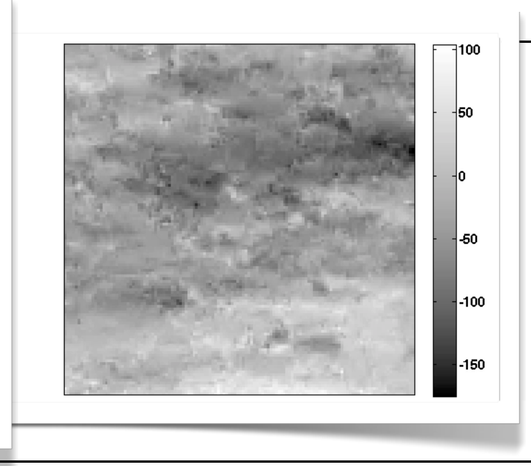




Research

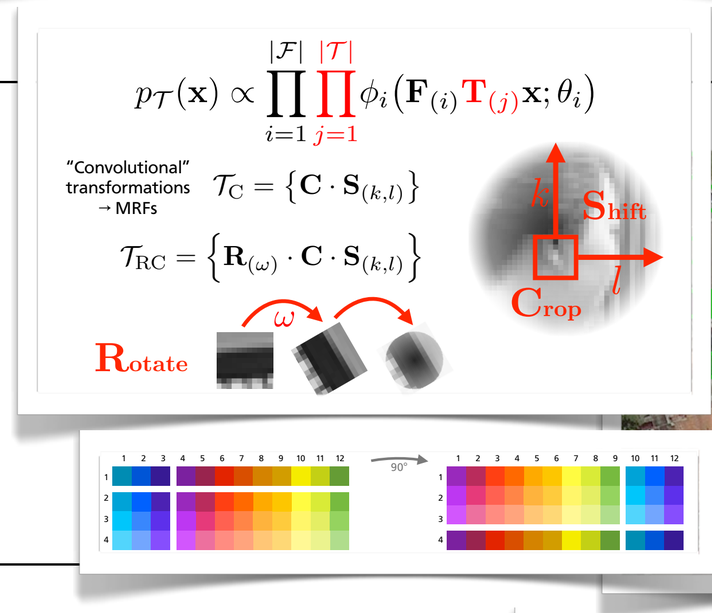
- Improving parametric image models
- Learning model parameters from data
- Evaluating quality of image models
- Sampling-based inference

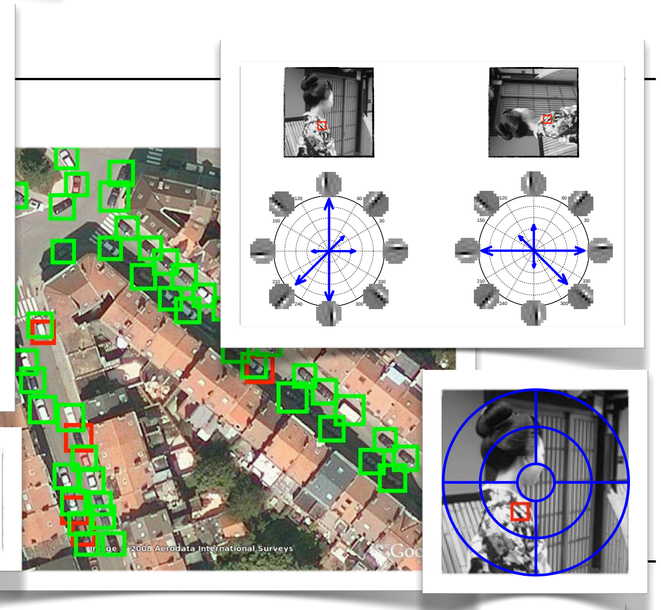




Current State

- Learned application-neutral image models with good statistical properties and good results in image restoration tasks
- Extension with integrated noise estimation
- Transformation in-/equivariant extension
- Rotation in-/equivariant image descriptor





Next Steps

- More adaptive image models
- Model image formation process
- Combine discriminative and generative approaches

- **Generative**
  - model $p(\mathbf{x})$
  - train on natural images
  - ✔ application neutral
  - ✘ learning & inference is more difficult
- **Discriminative**
  - model $p(\mathbf{x}|\mathbf{y})$
  - train on input/output pairs
  - ✘ application specific
  - ✔ learning & inference are generally easier
  - ✔ can lead to better performance