

Motivation

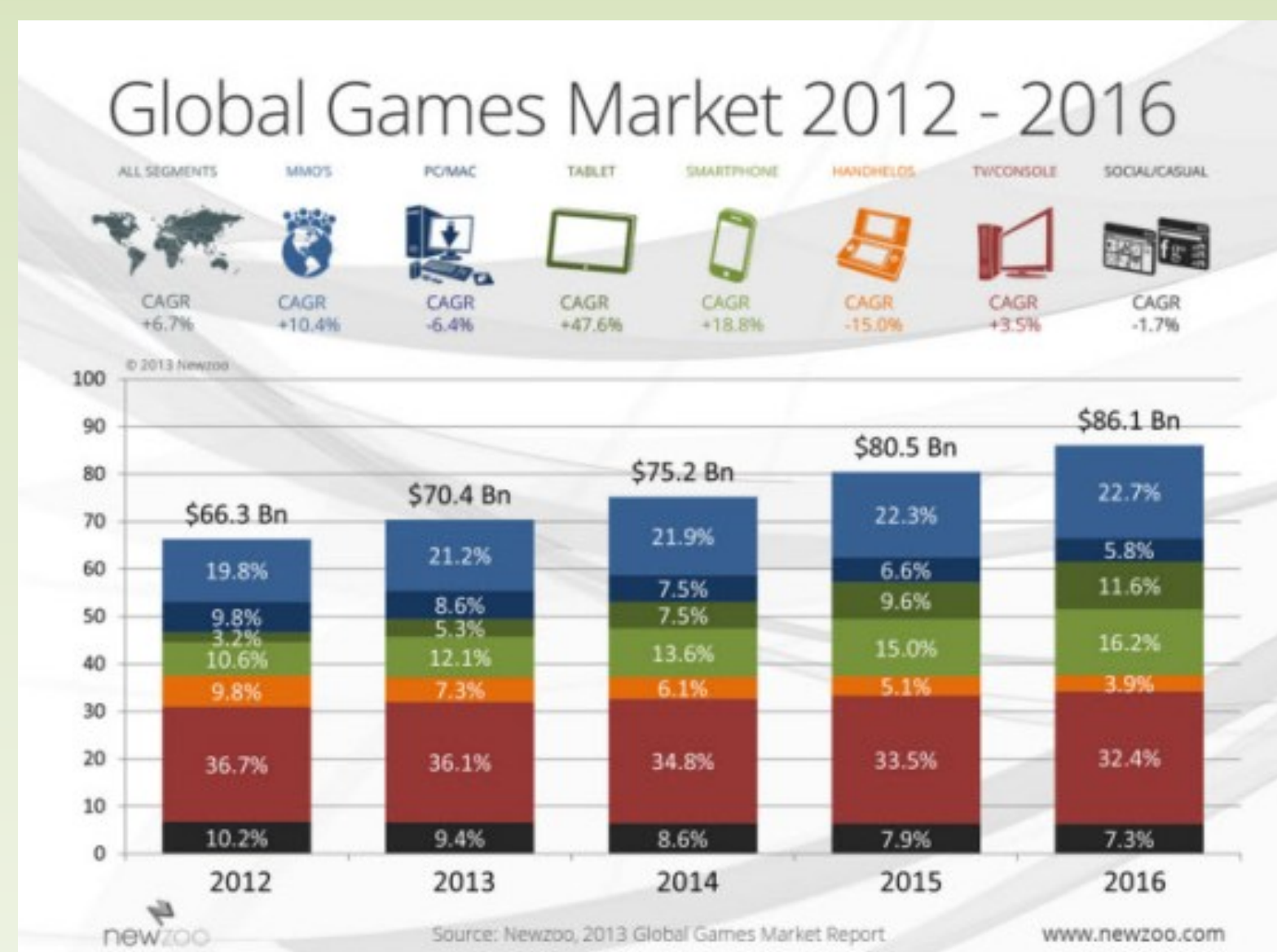
- No-reference evaluation of natural scenes
 - Scene Statistics used in visual quality assessment
- Aim: No-reference evaluation of synthetic images using scene statistics



- Can be used in efficient rendering and transmission
 - Adapt spatio-temporal resolution
 - Reduce power consumption

Synthetic Scenes

- Sources of graphics data:
 - PAST: Animation studios
 - NOW: Kinect, video games
- Artifacts:
 - Aliasing, banding, ringing, noise, blur
 - JPEG and wireless distortions
- Multiple artifacts often occur at the same time



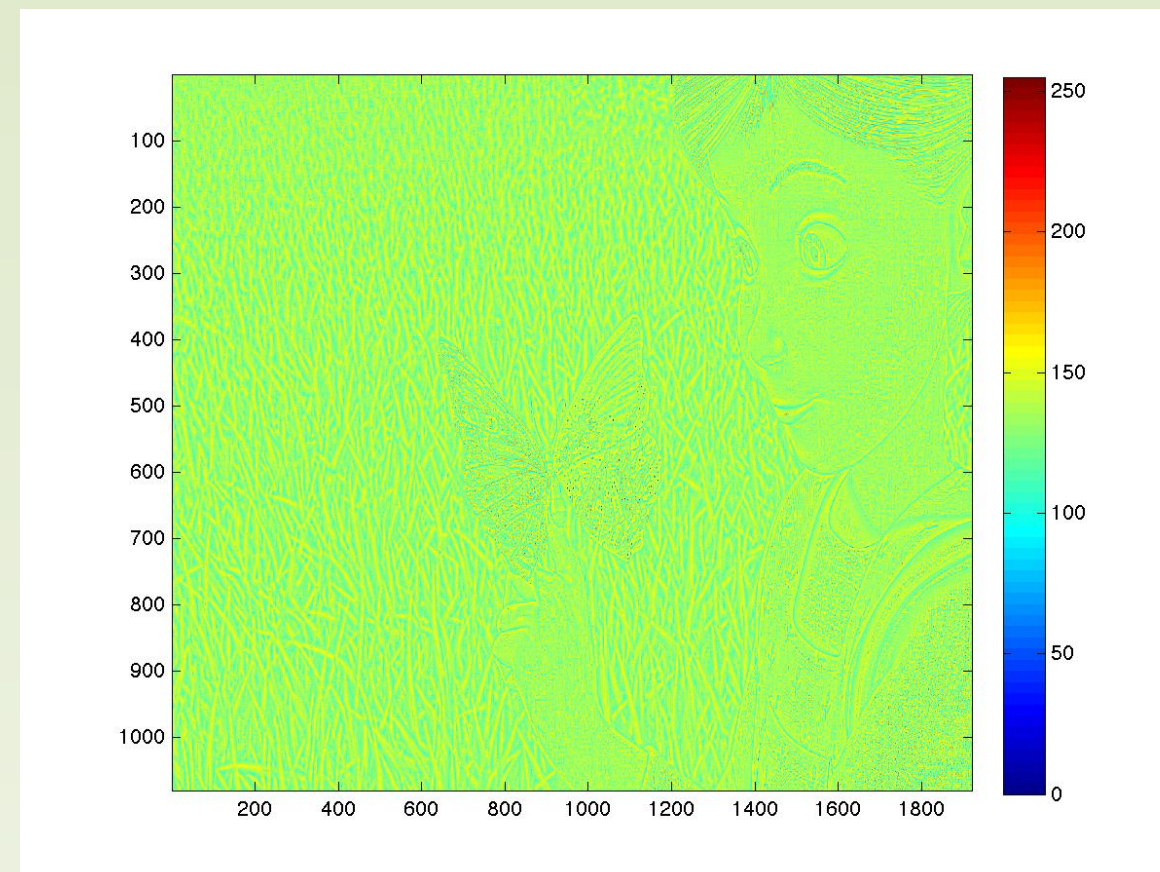
MSCN Coefficients

- Mean Subtracted Contrast Normalized (MSCN) coefficients successfully used in no-reference method using NSS [Mittal2013]
- Replicates processing in primary visual cortex
- Let $I(i, j)$ be the pixel located at (i, j) th spatial location

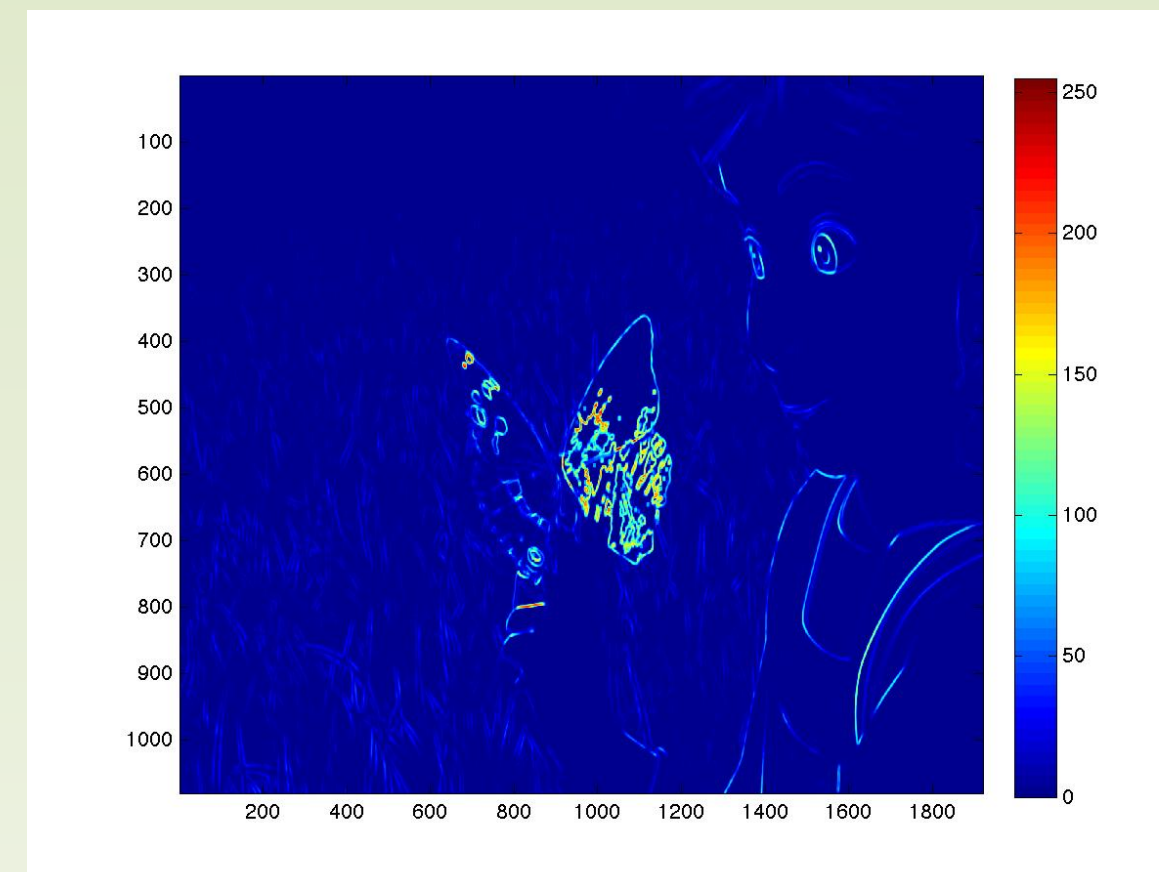
$$\text{MSCN}, \hat{I}(i, j) = \frac{I(i, j) - \mu(i, j)}{\sigma(i, j) + 1}$$

$$\text{Mean } \mu(i, j) = \sum_{k=-K}^K \sum_{l=-L}^L w_{k,l} I(i+k, j+l)$$

$$\text{Standard Deviation } \sigma(i, j) = \sqrt{\sum_{k=-K}^K \sum_{l=-L}^L w_{k,l} [I(i+k, j+l) - \mu(i, j)]^2}$$

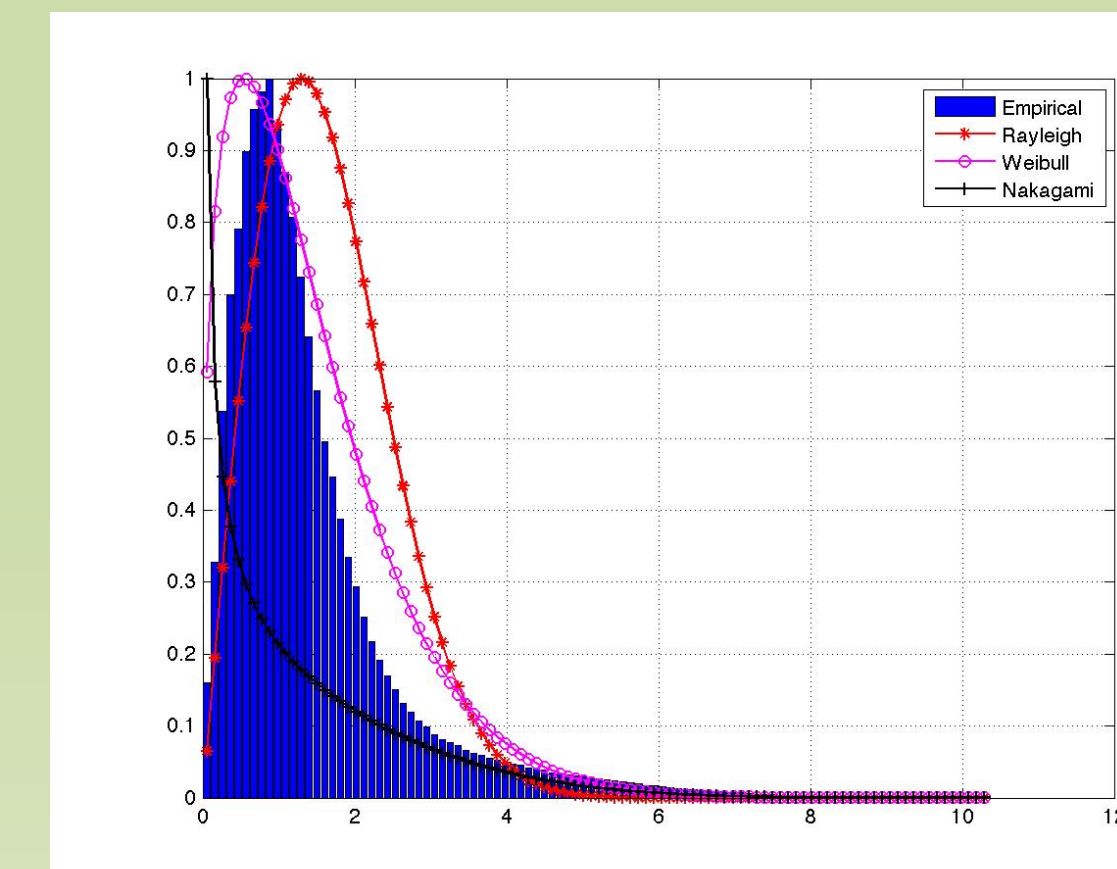


MSCN Coefficient Image

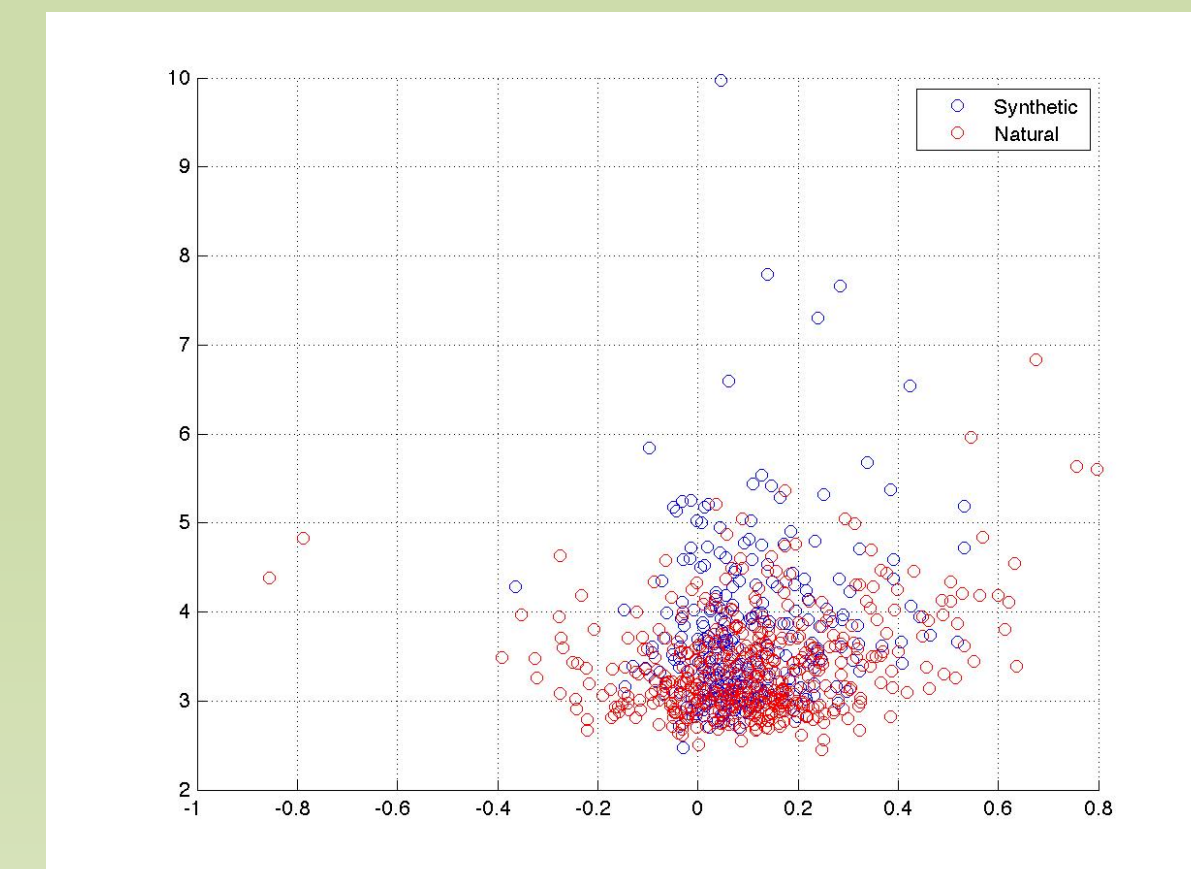


Standard Deviation Image

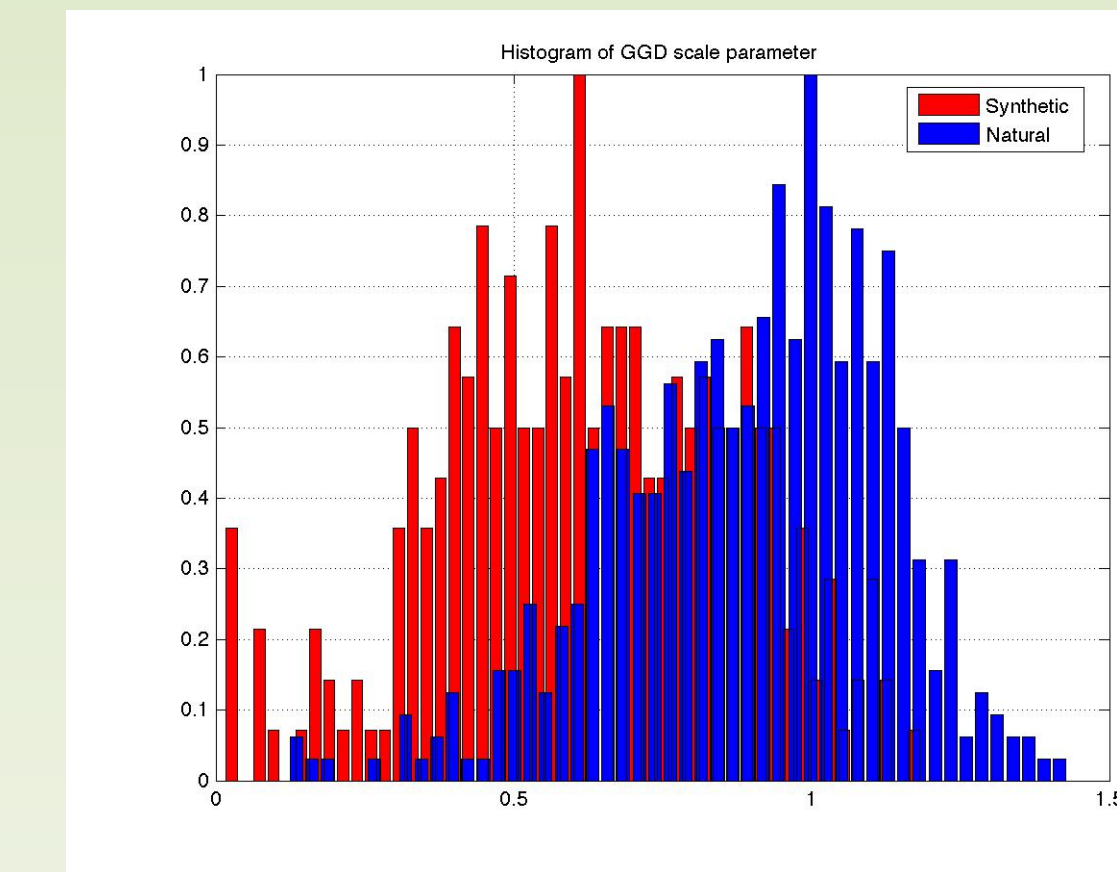
Distribution of MSCN coefficients



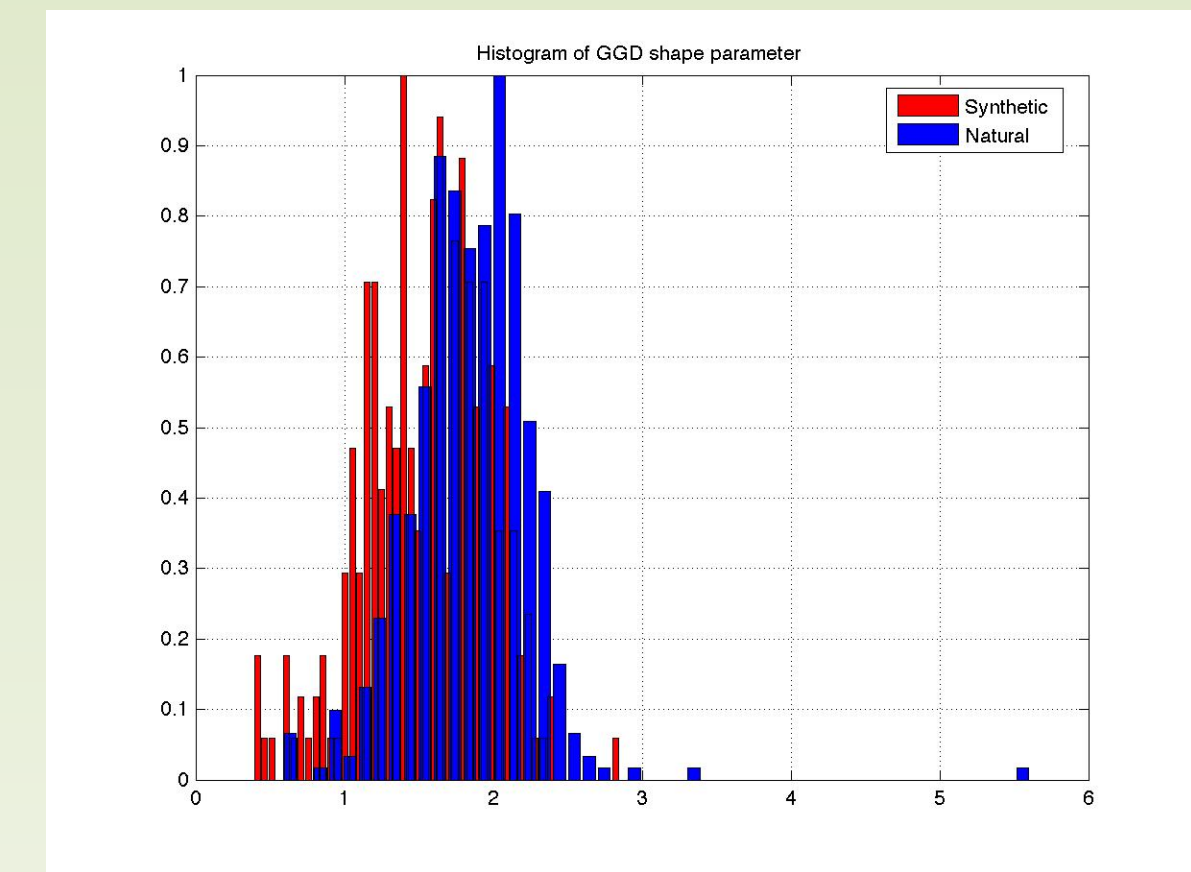
Histogram of gradient of MSCN coefficients and the fitted Rayleigh, Weibull and Nakagami distributions



Skewness-kurtosis scatter plot of MSCN coefficients of synthetic images [Kundu2014] and natural images [Martin2001]



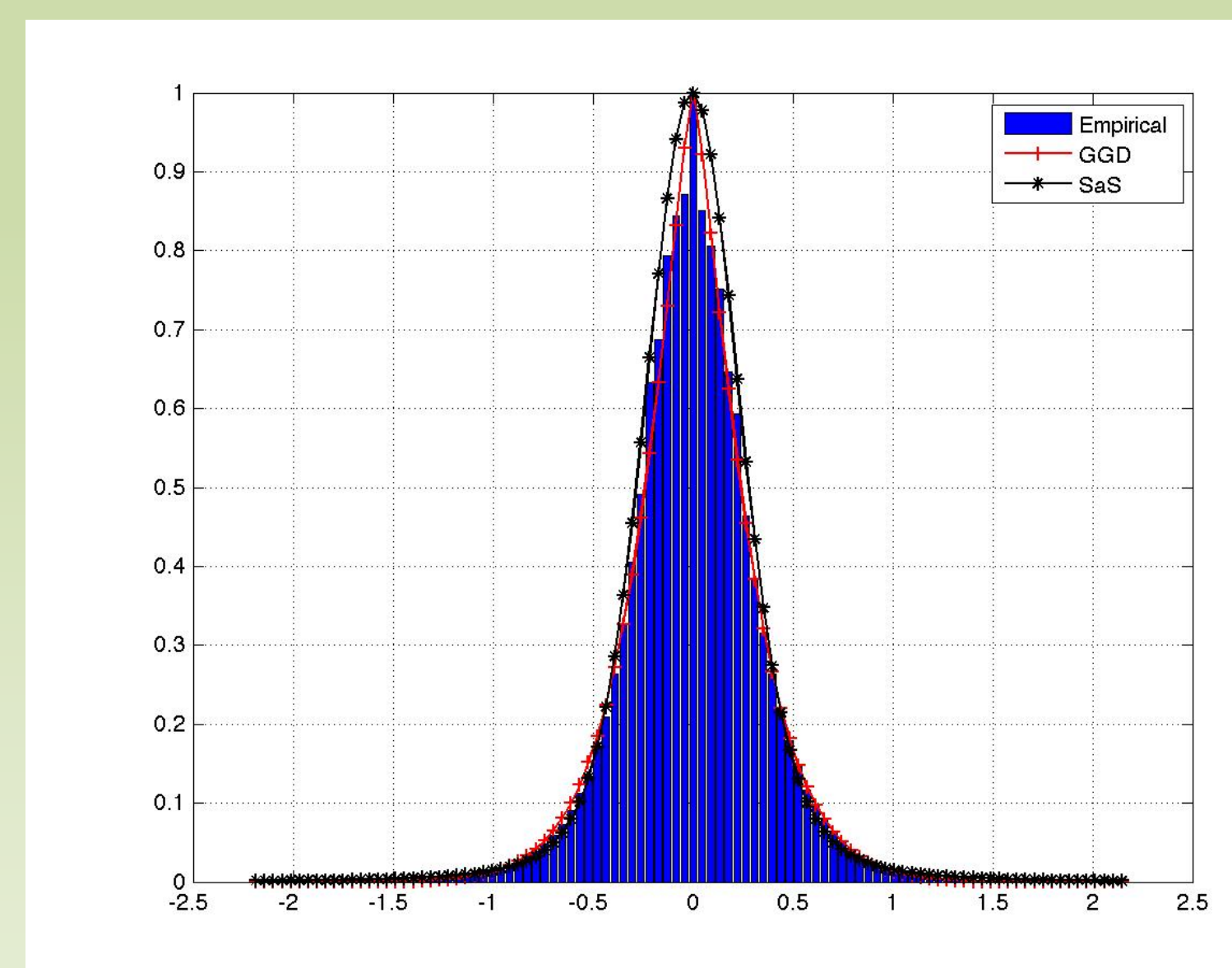
Histogram of scale parameter



Histogram of shape parameter

Distribution of MSCN coefficients

- Generalized Gaussian distribution fit to MSCN coefficients



- MSCN Coefficients
 - Heavily kurtotic distributions modeled better by the Alpha Stable distributions
 - Gradients modeled using Rayleigh, Weibull and Nakagami distributions

Conclusion

- Created synthetic image database with 200+ images
- Generalized Gaussian and Alpha Stable distributions can also model MSCN coefficients of synthetic images
 - Scale/shape parameters of MSCN coefficients for synthetic images varies slightly from natural images
- Unrealistic content does not change MSCN coefficient distribution, but distortions do**



Future Work

- Conduct subjective tests for pristine and distorted synthetic images to obtain ground truth ratings (ongoing)
- Use the subjective evaluations to design no-reference evaluation metric for computer graphics images
- Study the applicability of natural video statistics in rendering animation sequences

