

大话成像之 数字成像系统 32讲

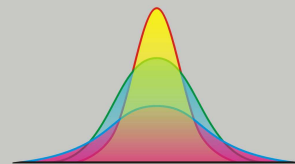
自动曝光

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AE 自动曝光 ? 亮度

感光度

光圈

快门速度

gamma

Tone mapping

Multi frame
HDR ..

Exposure time

Integration time: lines

global

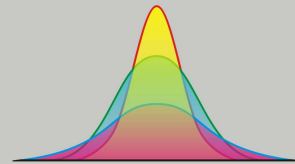
local

Sensor Analog
gain

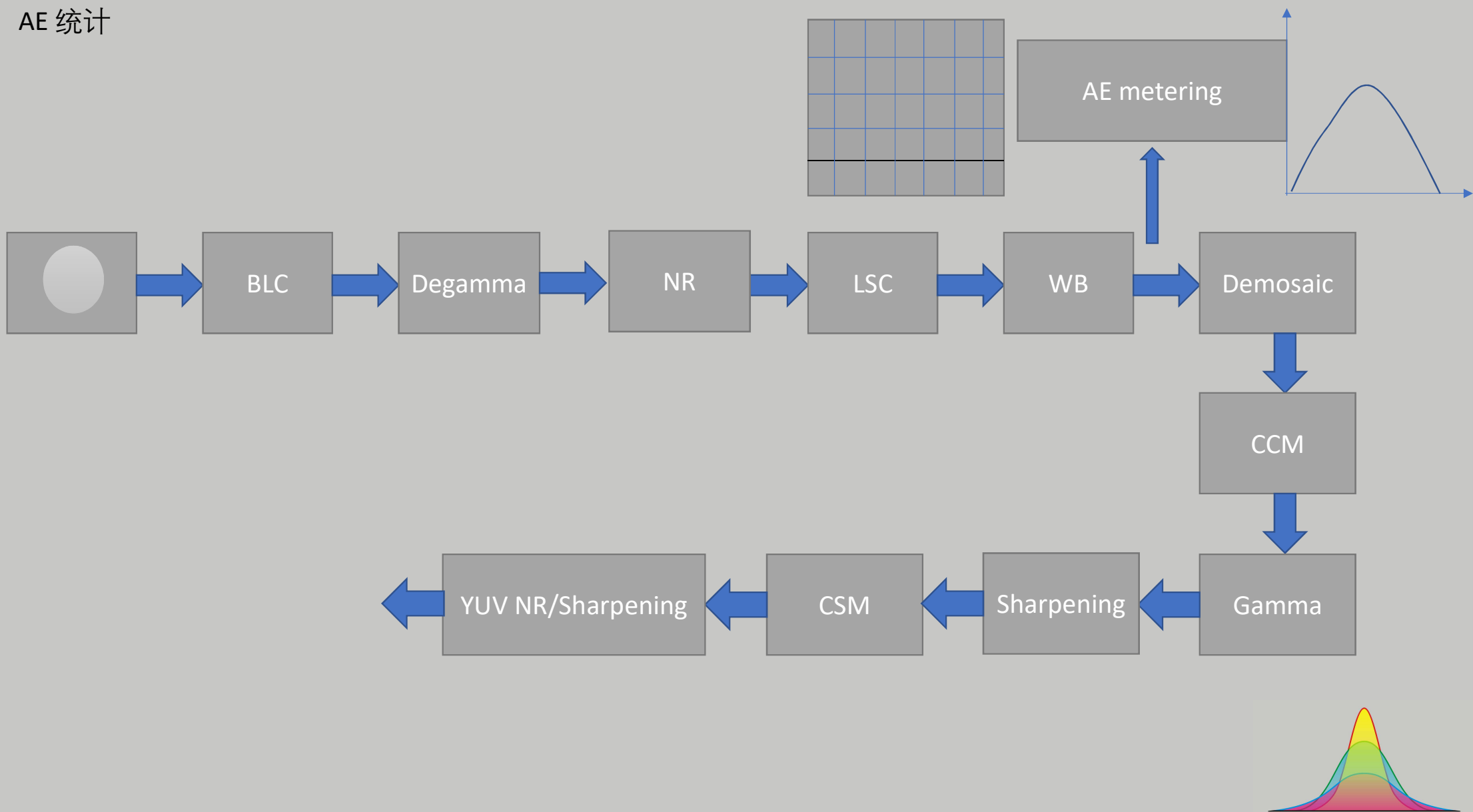
Sensor Digital
gain

ISP digital gain

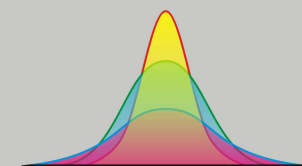
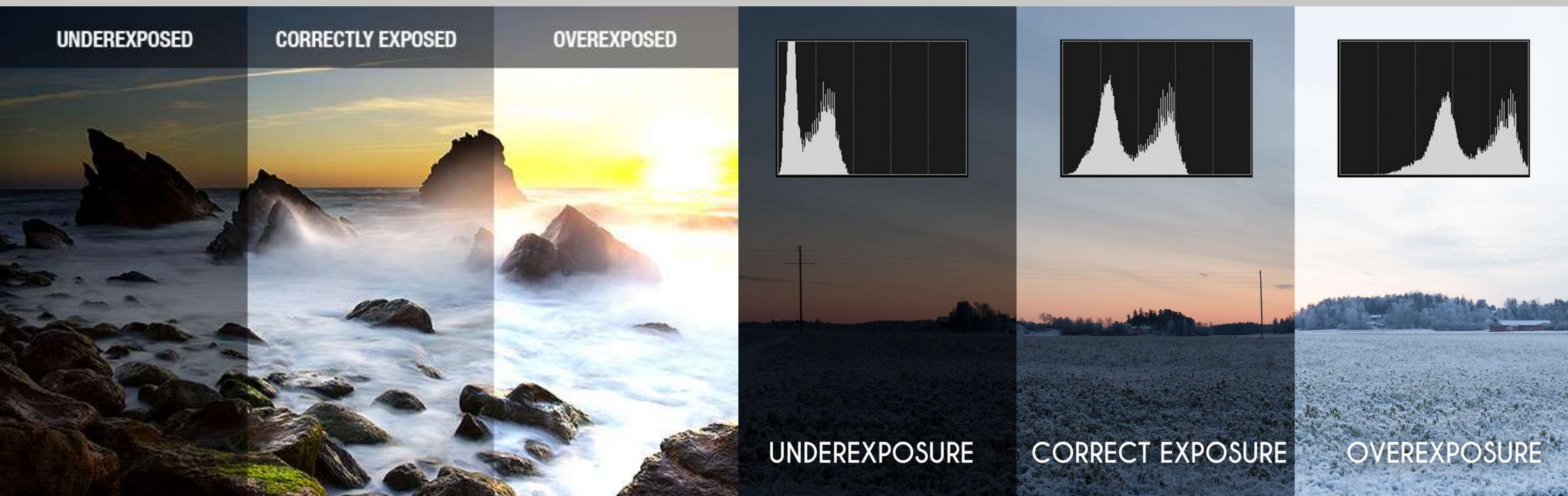
曝光 = ISO X 光圈 x 曝光时间 ;



AE 统计



什么是合适的曝光？



曝光误差的量化



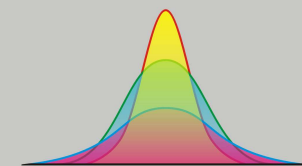
18%中性灰

243, 243, 242	200, 200, 200	160, 160, 160	122, 122, 121	85, 85, 85	52, 52, 52
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曝光误差 = $(\log_{10}(\text{实际像素值}) - \log_{10}(\text{像素参考值})) \times \text{gamma}^{-1}$

曝光误差 = (曝光误差21 + 曝光误差22 + 曝光误差23) / 3

曝光误差 = 曝光误差22



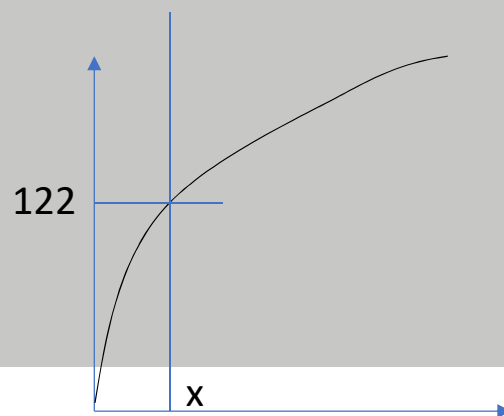
AE target : 均值法

曝光误差 = 曝光误差22

Input = 255 x (Output/255)^{gamma}

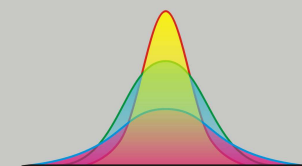
Output = 122, gamma = 2.2, input = 50

18% reflection rate hypothesis



Color Checker Chart					
Dark Skin R=115 G= 82 B= 68	Light Skin R=194 G=150 B=130	Blue Sky R= 98 G=122 B=157	Foliage R= 87 G=108 B= 67	Blue Flower R=133 G=128 B=177	Bluish Green R=103 G=189 B=170
Orange R=214 G=126 B= 44	Purple Red R= 80 G= 91 B=166	Moderate Red R=193 G= 90 B= 99	Purple R= 94 G= 60 B=108	Yellow Green R=157 G=188 B= 64	Orange Yellow R=224 G=163 B= 46
Blue R= 56 G= 61 B=150	Green R= 70 G=148 B= 73	Red R=175 G= 54 B= 60	Yellow R=231 G=199 B= 31	Magenta R=187 G= 86 B=149	Cyan R= 8 G=133 B=161
White R=243 G=243 B=242	Neutral 8 R=200 G=200 B=200	Neutral 65 R=160 G=160 B=160	Neutral 5 R=122 G=122 B=121	Neutral 35 R= 85 G= 85 B= 85	Black R= 52 G= 52 B= 52
X-Rite					
200	400	600	800	1000	1200

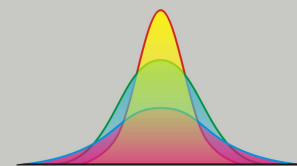
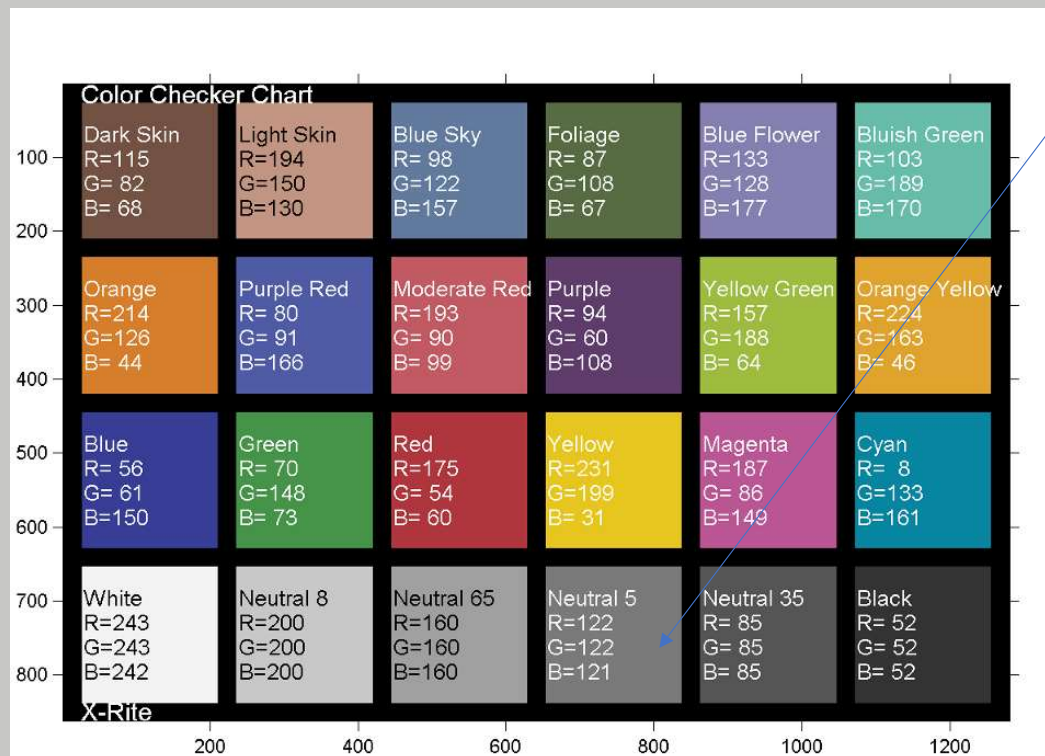
18%



18% reflection rate hypothesis failure

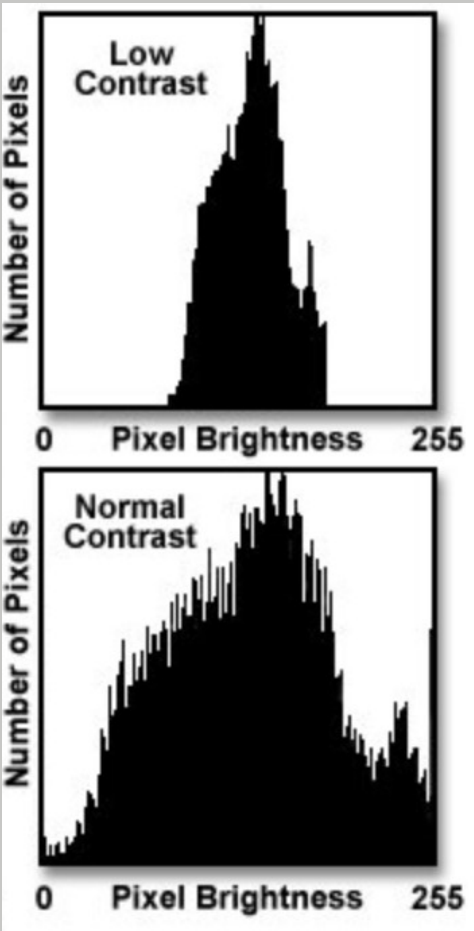
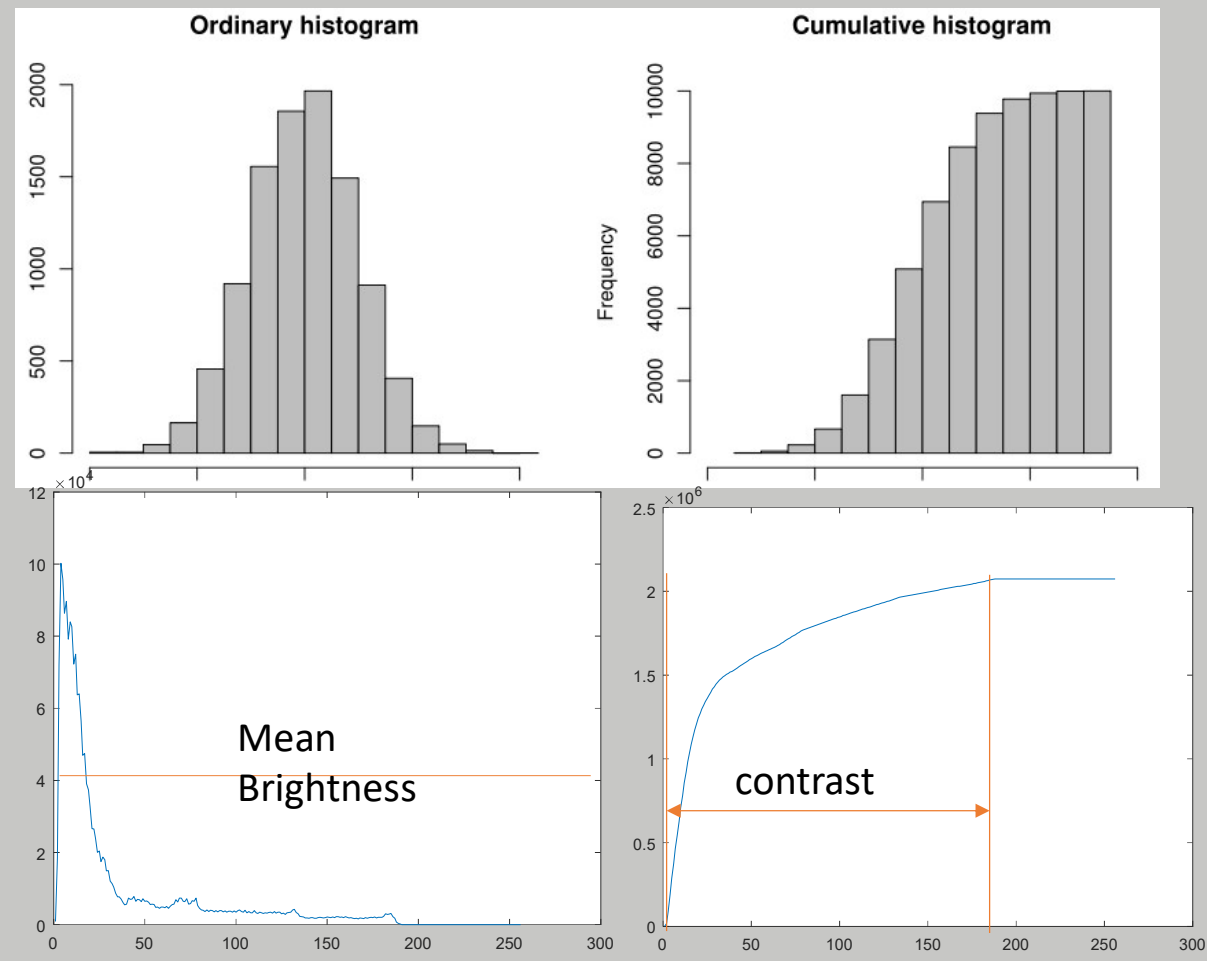


18% neutral grey card

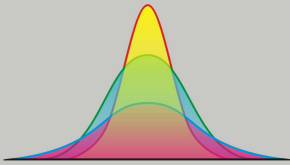


均值法AE 的改进：

直方图 histogram 与 积分直方图 Cumulative histogram



https://en.wikipedia.org/wiki/Image_histogram



AE loop

sensor

Frame

感光度

光圈

快门速度

Sensor Analog
gain

Exposure time

Sensor Digital
gain

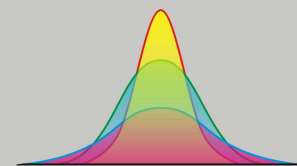
Integration time: lines

ISP digital gain

新曝光
参数

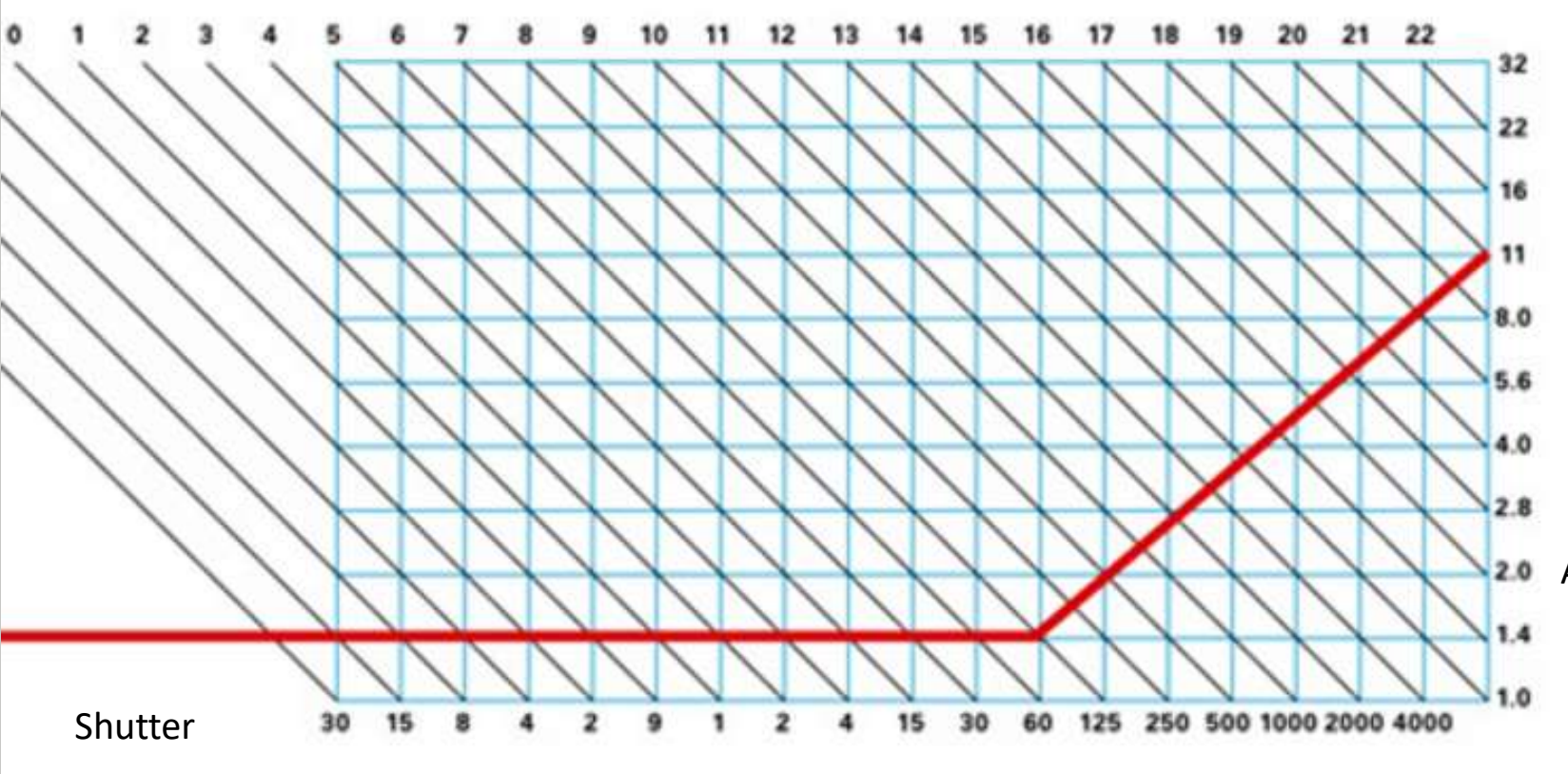
ISP AE
统计

新 AE
Target



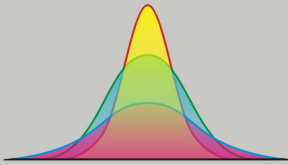
AE program :

EV

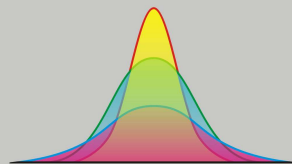
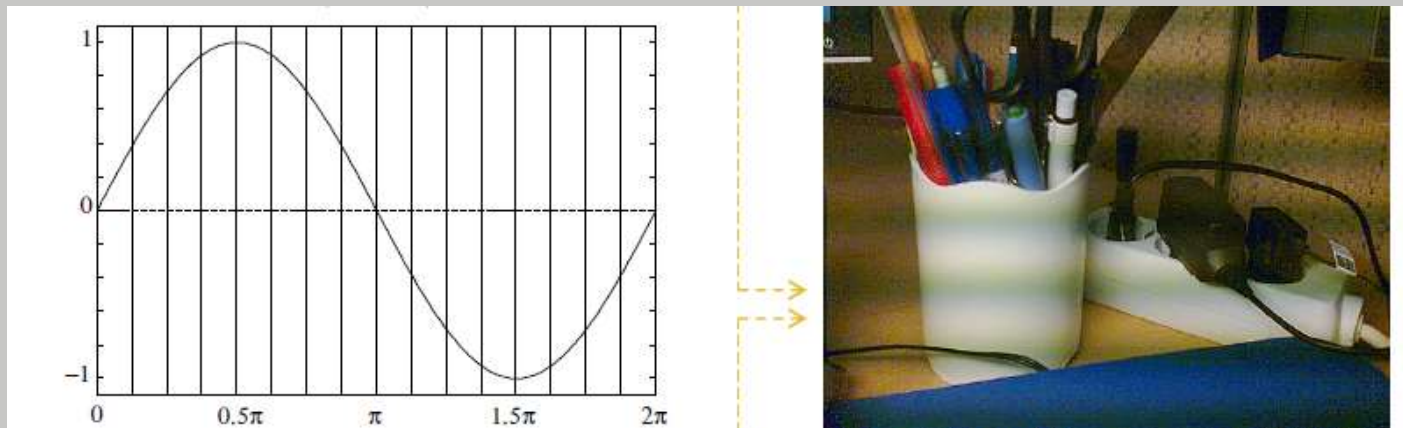


Aperture

Shutter

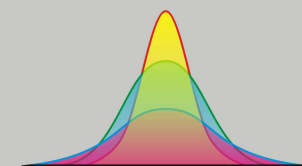


Flickering Reduction



THANKS

本课程由 Maver Jiang提供



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内容目录

1. 数字成像系统介绍
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