



Photo credit: Chihuly Garden and Glass

## Edge-Preserving Blur

施雅方  
Ya-Fang Shih



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# Edge-preserving Blur

Blur images while preserving edges and texture.



Photo credit: Chihuly Garden and Glass



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Photo credit: Dean Cheng

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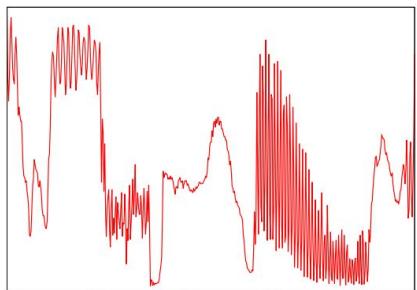
Photo credit: Chihuly Garden and Glass



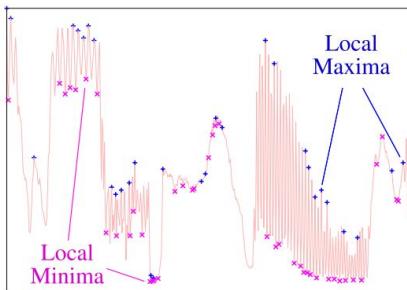
Photo credit: Dean Cheng

# Edge-preserving multiscale image decomposition based on local extrema.

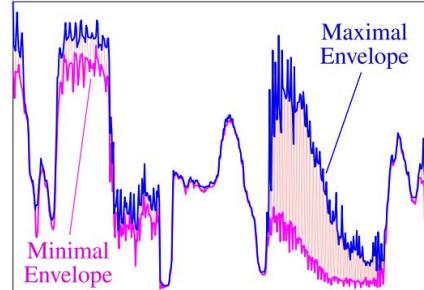
Subr, Kartic, Cyril Soler, and Frédo Durand. ACM Transactions on Graphics (TOG) 28.5 (2009): 147.



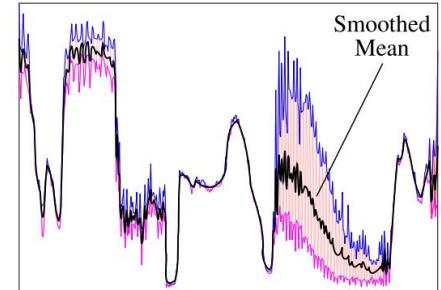
Input



Step 1: Locate extrema



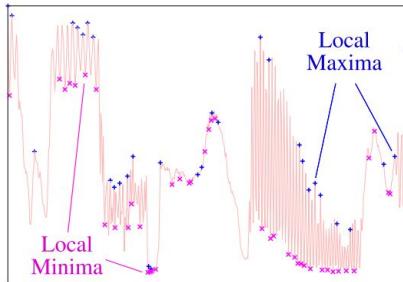
Step 2: Compute envelopes



Step 3: Average envelopes

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Step 1: Locate extrema

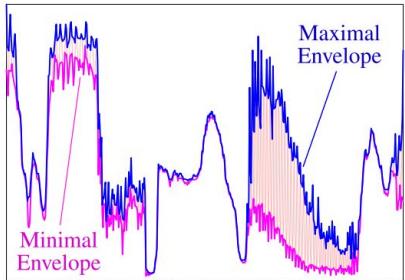
- 1) within a  $k \times k$  kernel

local min:  $|neighbor < myself| \leq k-1$

local Max:  $|neighbor > myself| \leq k-1$

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Step 2: Compute envelopes

## 2) Interpolating envelopes

$E(r)$  : envelope value at  $r$

$N(r)$  : neighbors of  $r$

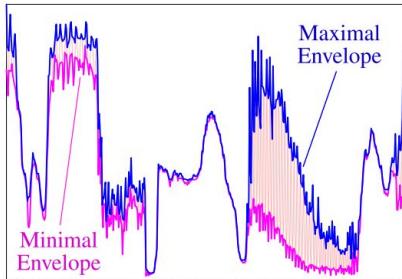
$$\min \left( \sum_r (E(r) - \sum_{s \in N(r)} \omega_{rs} E(s))^2 \right) \quad \text{you should look like your neighbors}$$

$$\omega_{rs} \propto \exp(- (I(r) - I(s))^2 / 2\sigma_r^2)$$

$$\forall r \in \text{localmin, localMax} \quad E(r) = I(r) \text{ edge preserved}$$

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Step 2: Compute envelopes

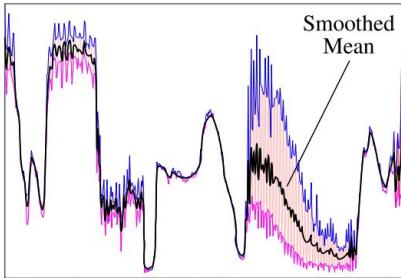
$$2) \min \left( \sum_r (E(r) - \sum_{s \in N(r)} \omega_{rs} E(s))^2 \right)$$

$$\begin{bmatrix} 1 & -\omega_{r_1s_1} & 0 & 0 & \dots & -\omega_{r_2s_2} \\ & 0 & \dots & 0 & 1 & 0 & \dots \end{bmatrix} \begin{bmatrix} E(r_1) \\ \vdots \\ E(r_m) \end{bmatrix} = \begin{bmatrix} 0 \\ \vdots \\ I(r_m) \end{bmatrix}$$

**A**      **x**      =      **b**

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Step 3: Average envelopes

3) Blurred mean =  $(\text{minEnvelope} + \text{MaxEnvelope}) / 2$

# Result

input, k=5,  
k=9, k=13.



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# Result

input, k=5,  
k=9, k=13.

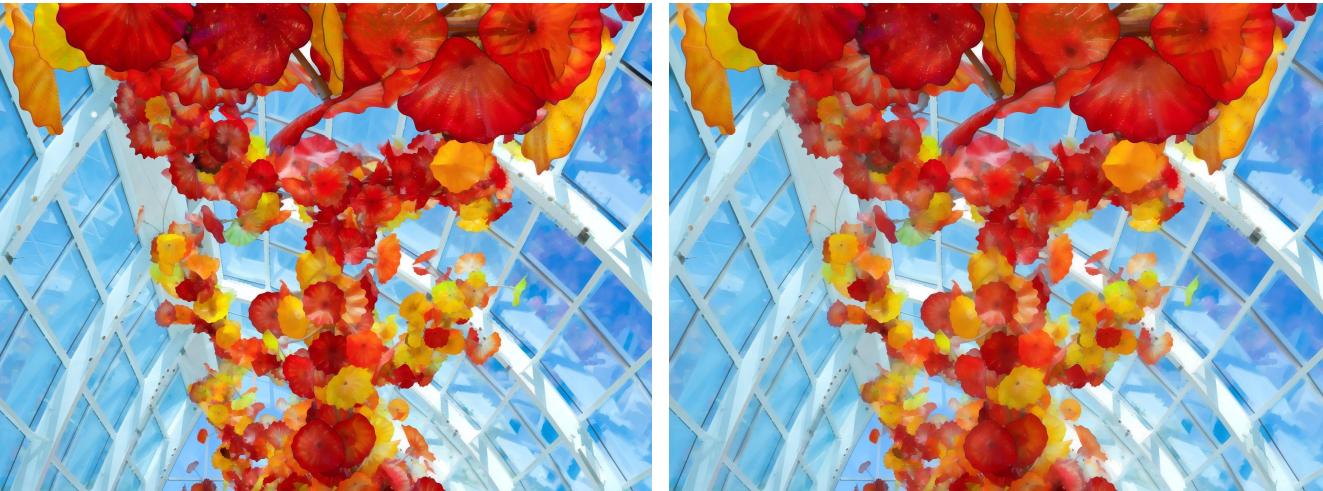


Photo credit: Chihuly Garden and Glass

# Result

input, k=5, k=9, k=13.



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