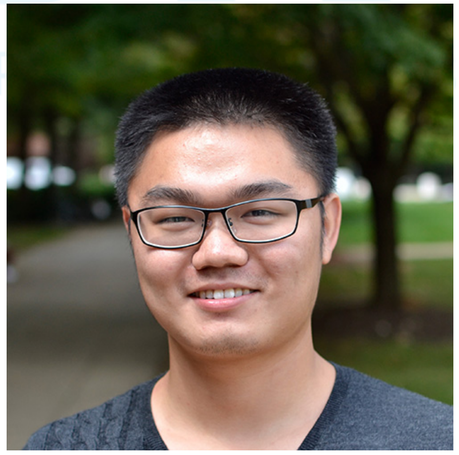
LoCoPalettes: Local Control for Palette-based Image Editing

Cheng-Kang Ted Chao

Jason Klein

Jianchao Tan



Jose Echevarria

Yotam Gingold

Palette-based Image Recoloring

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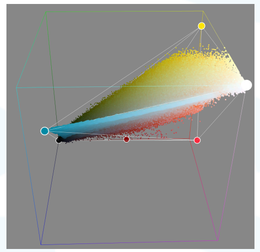

Color space visualization: https://yig.github.io/image-rgb-in-3D/

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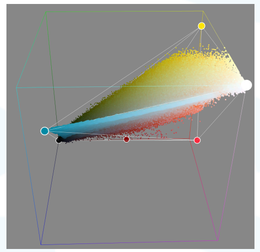

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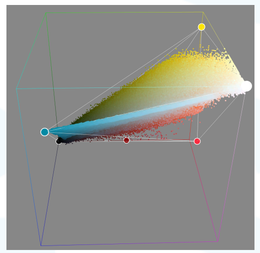

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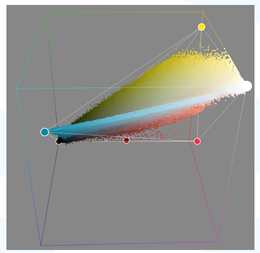

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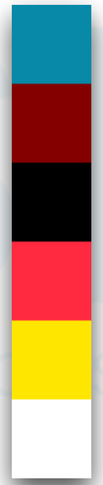

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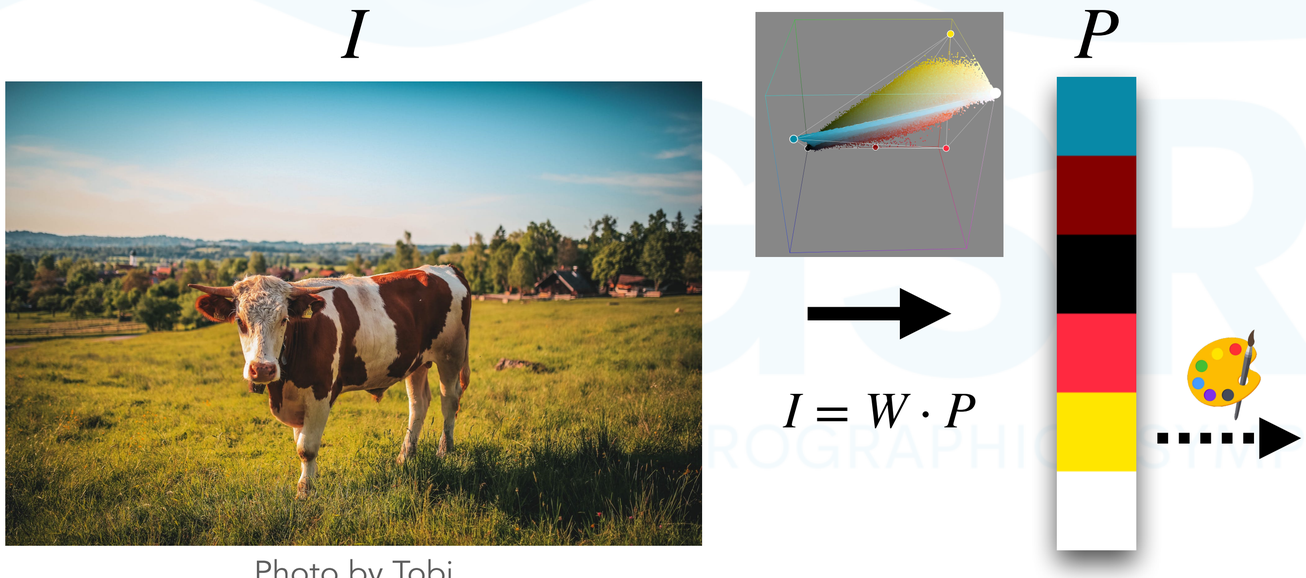

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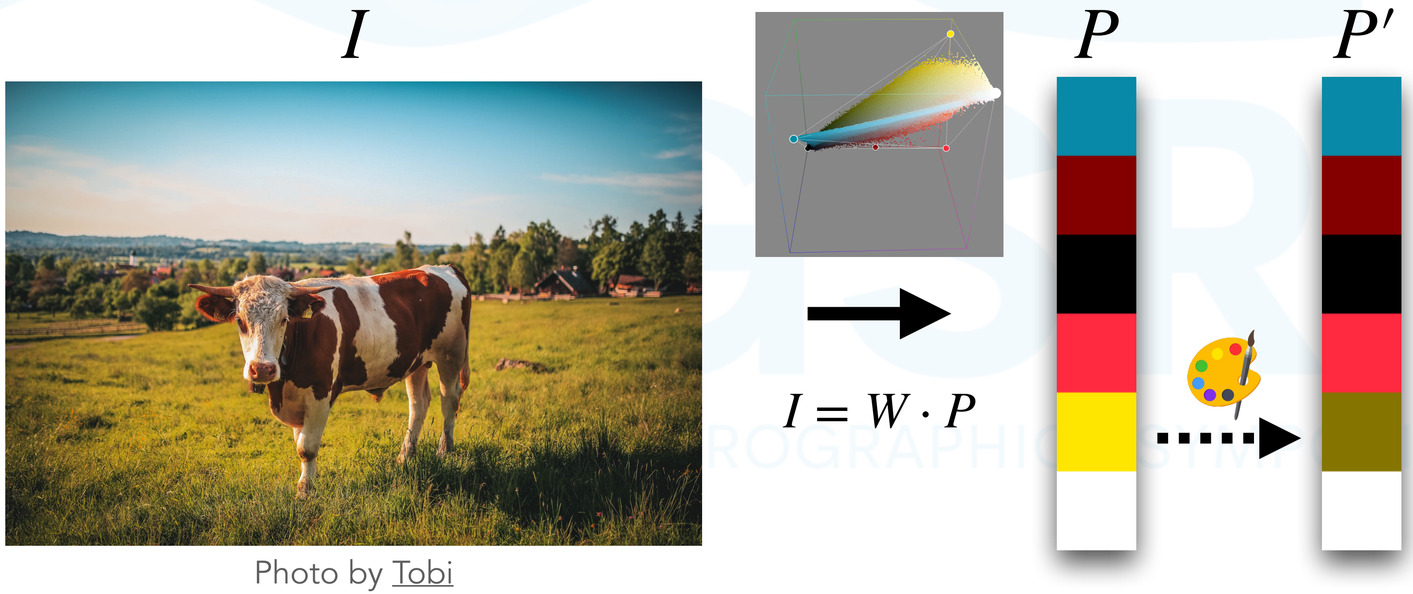

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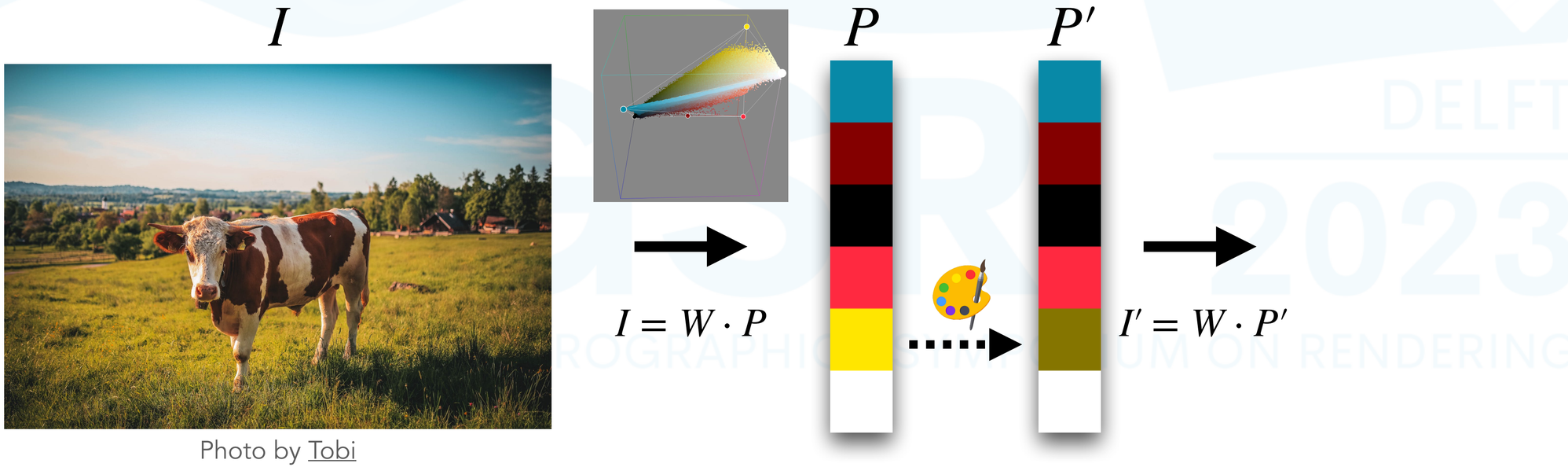

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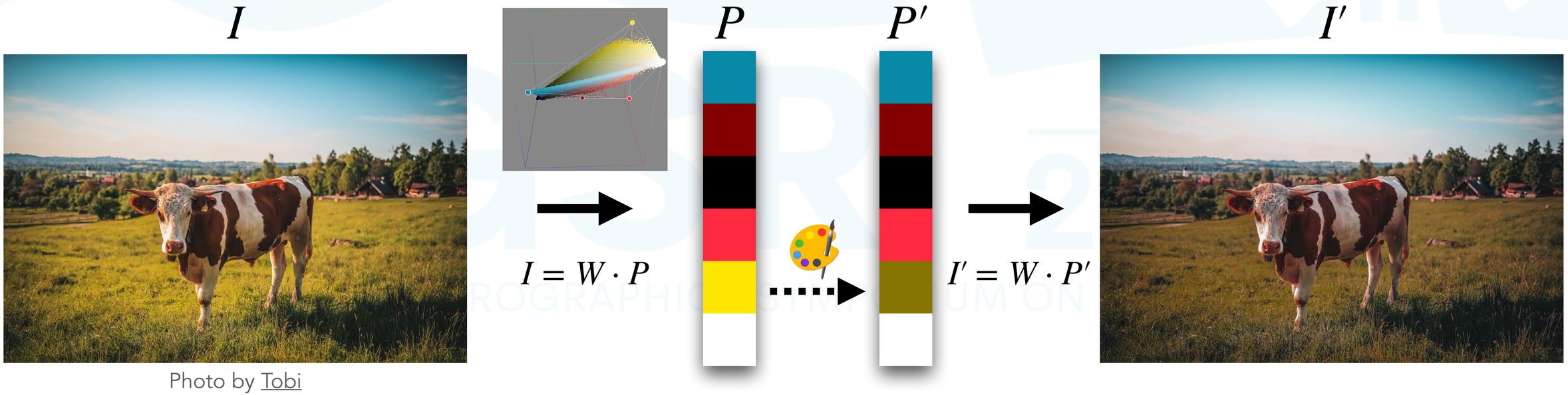

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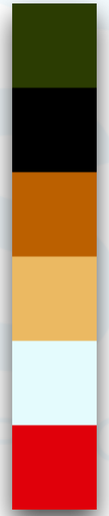

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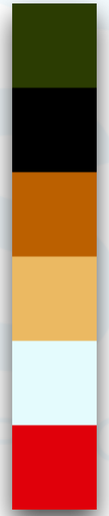

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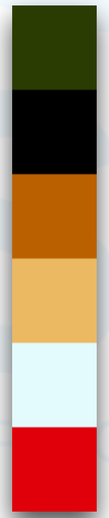

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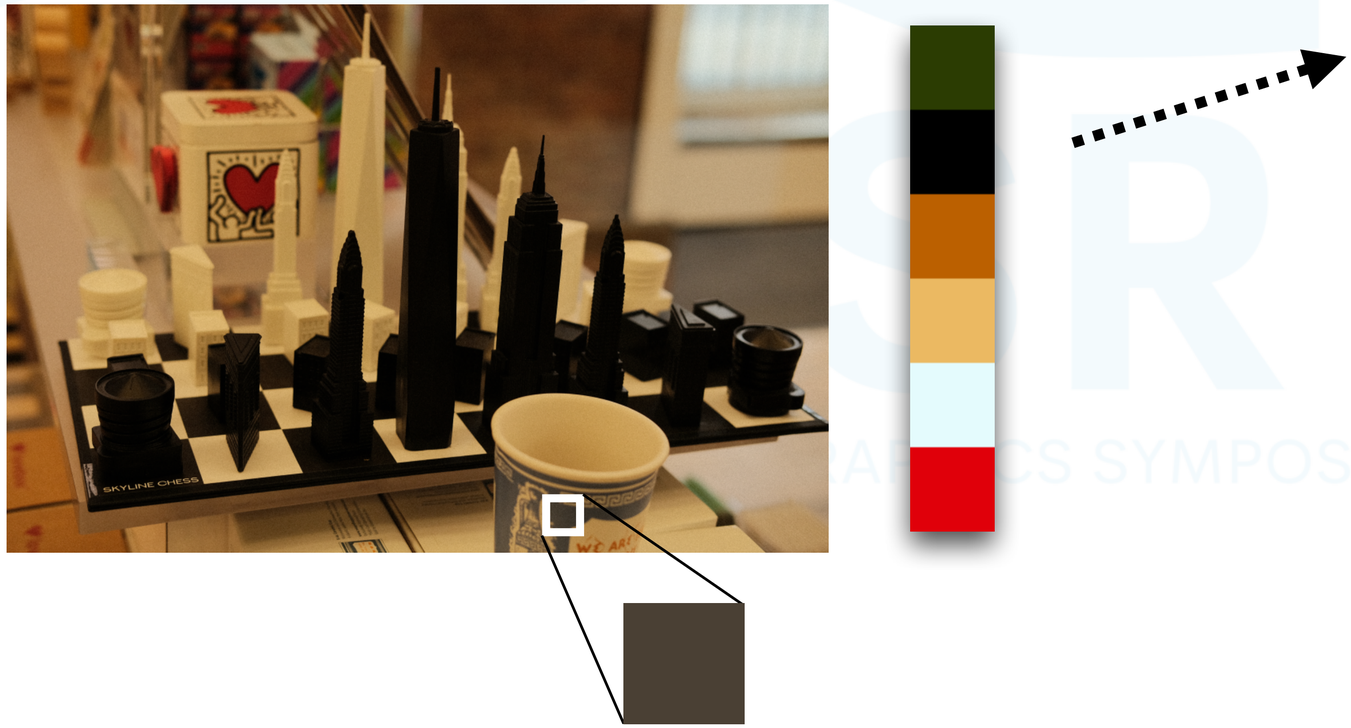

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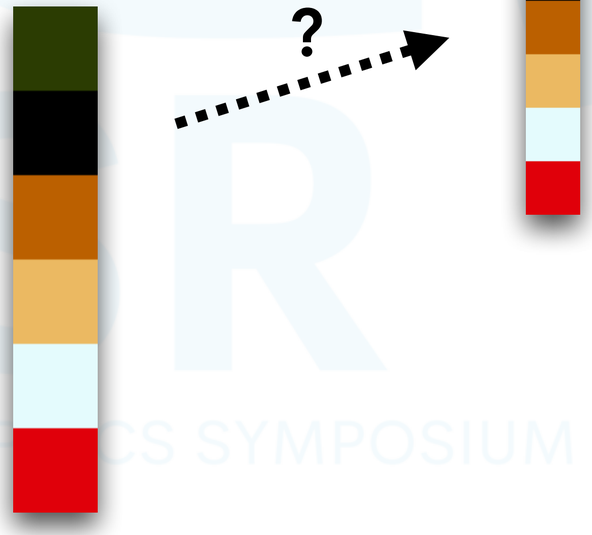

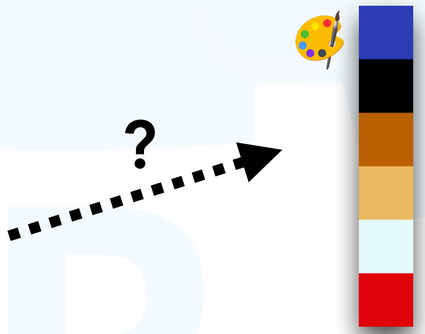

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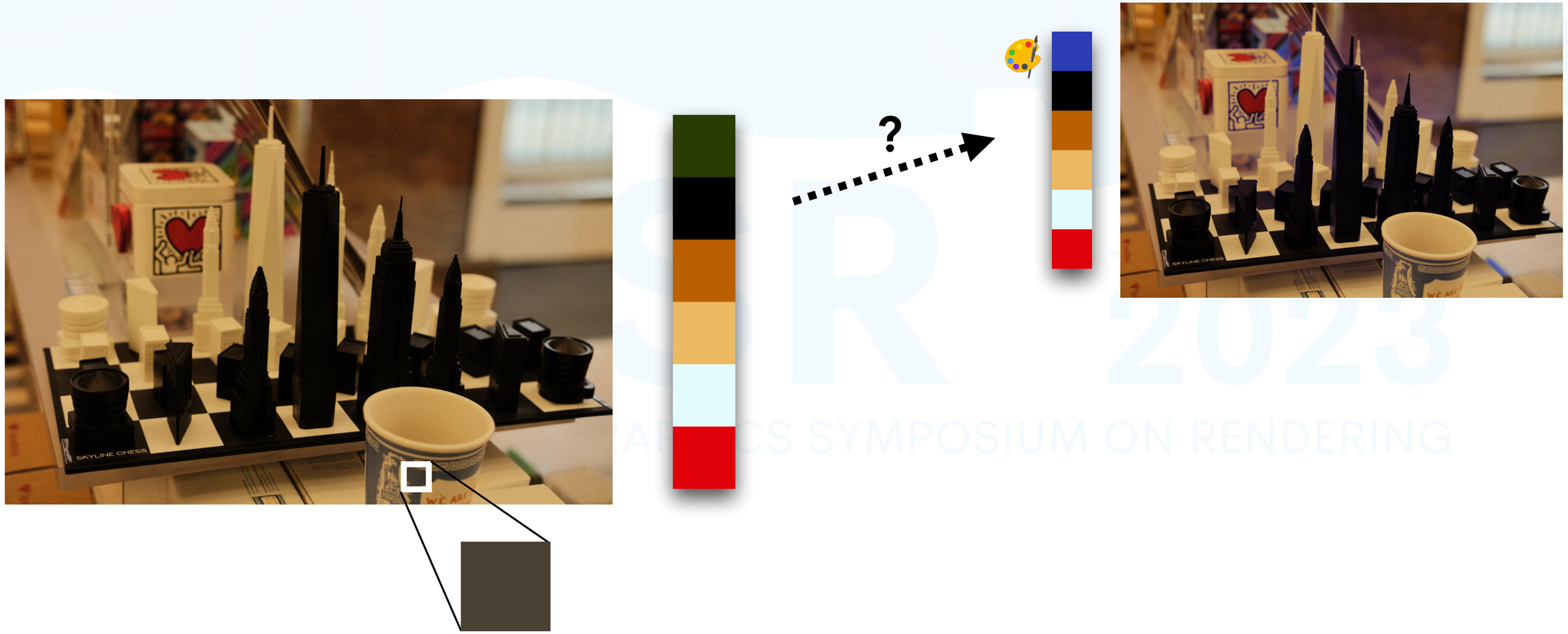

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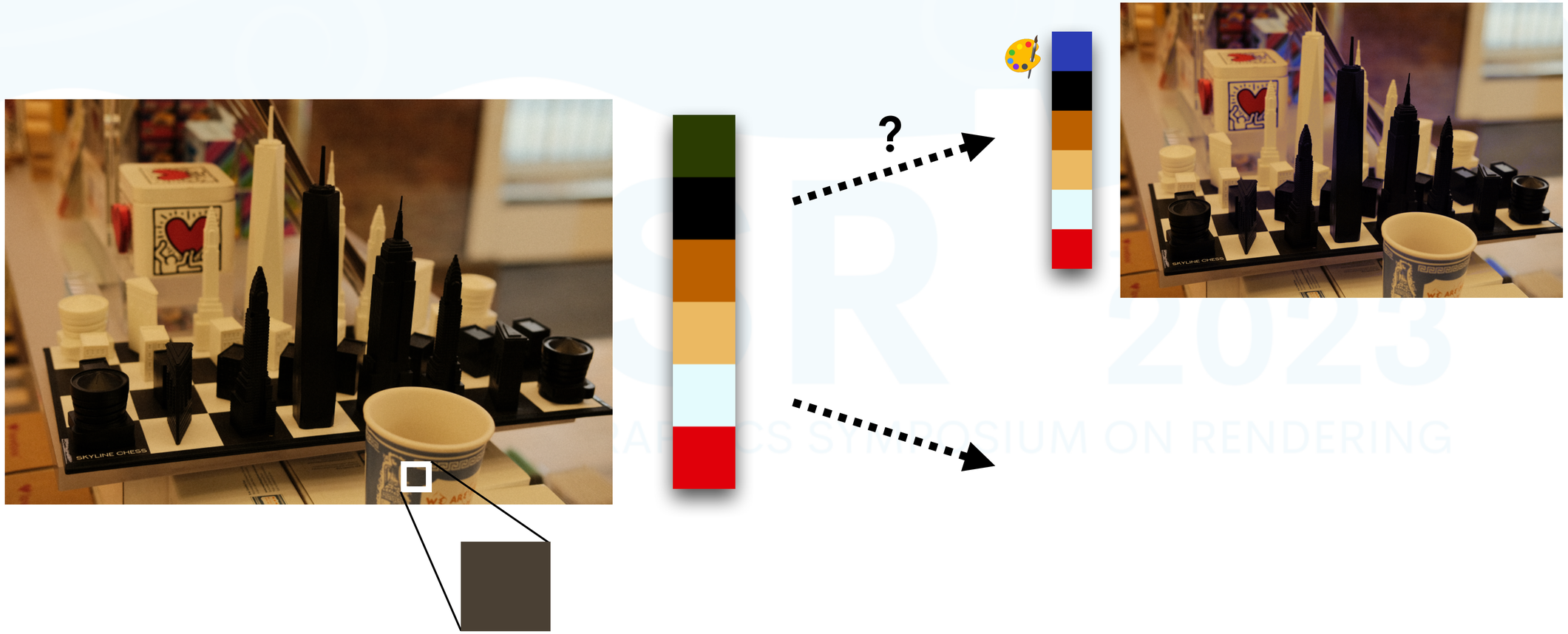

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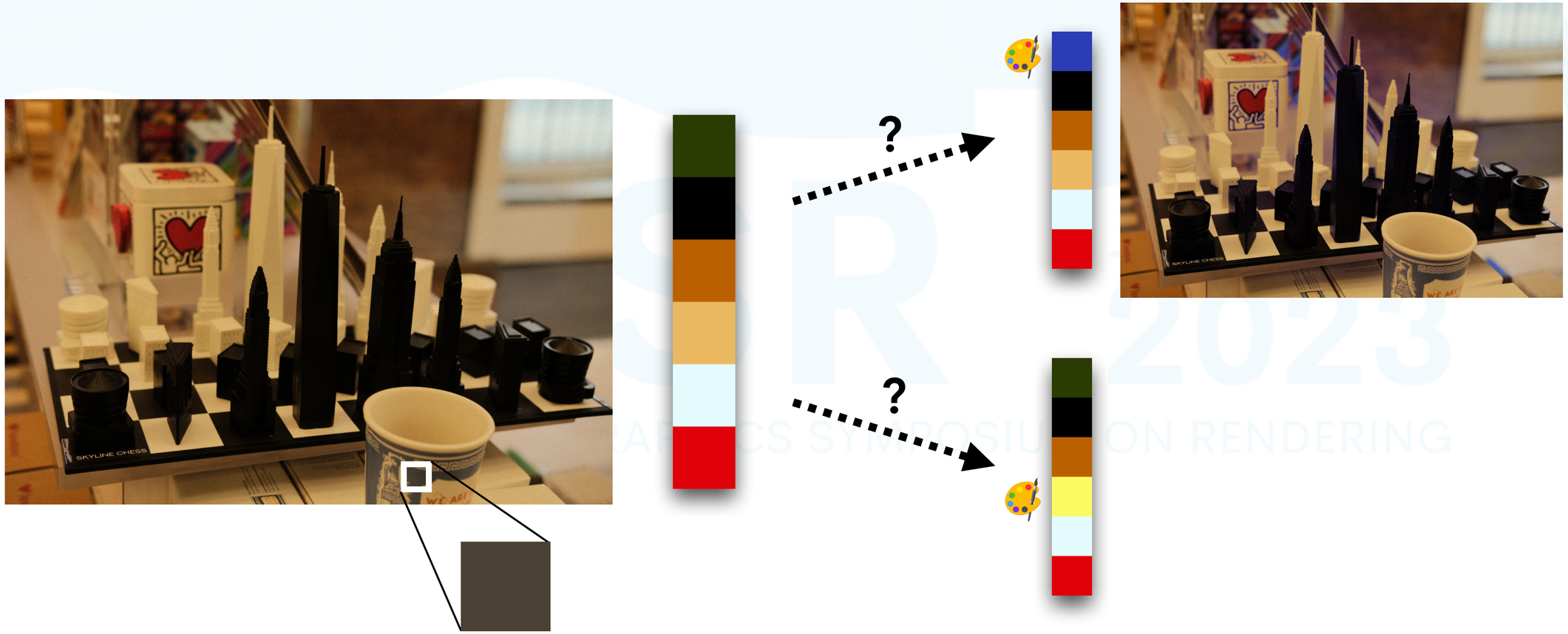

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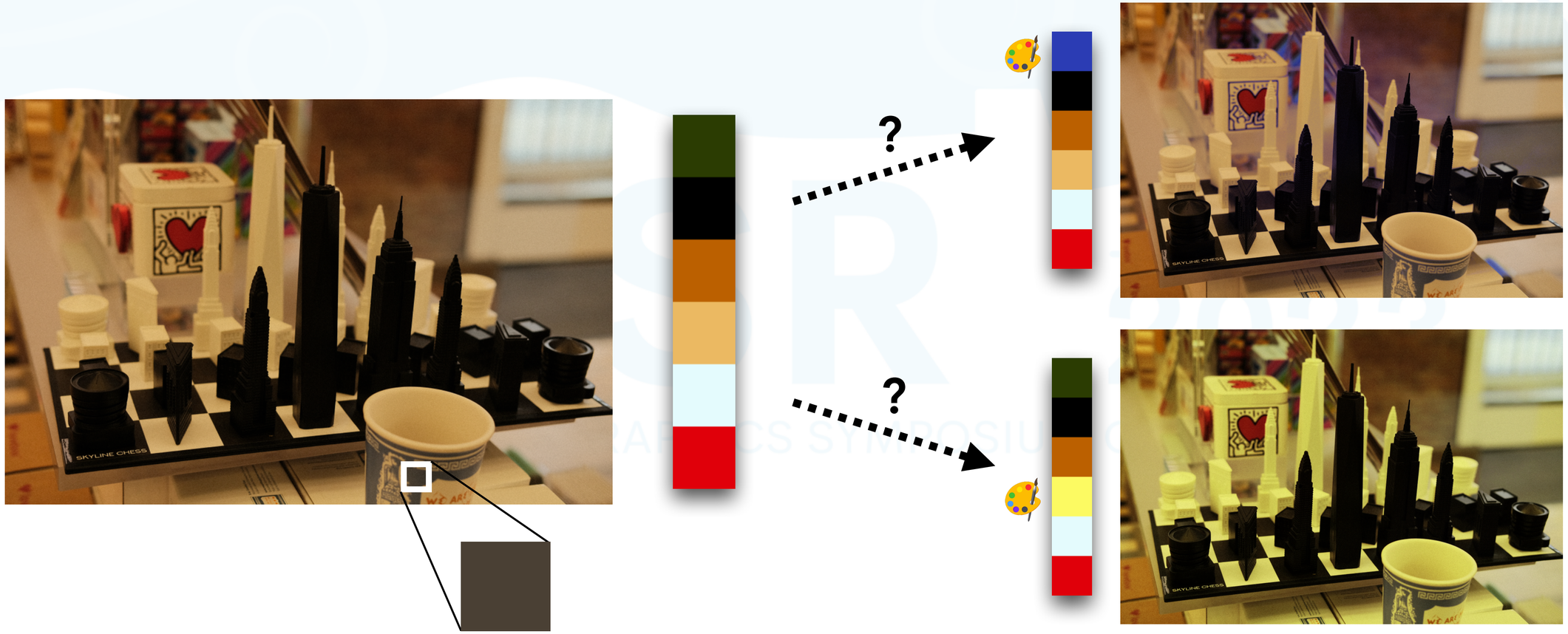

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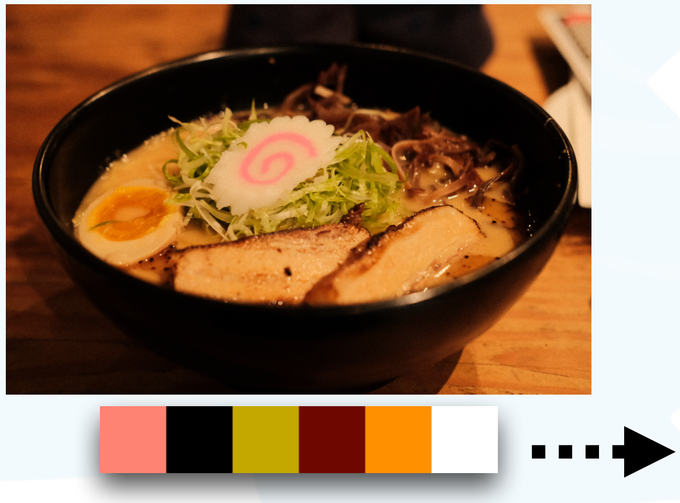

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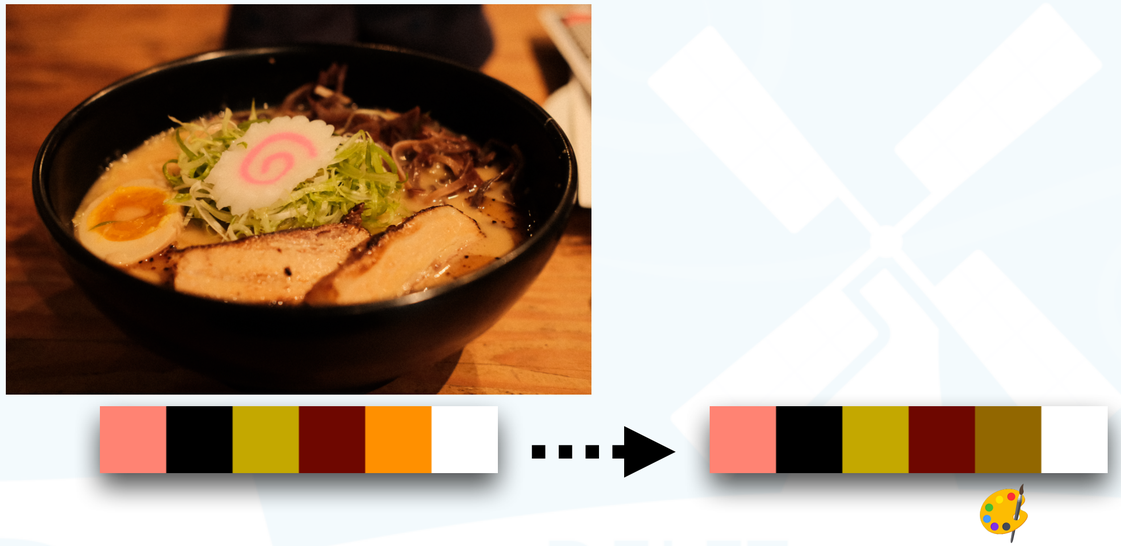

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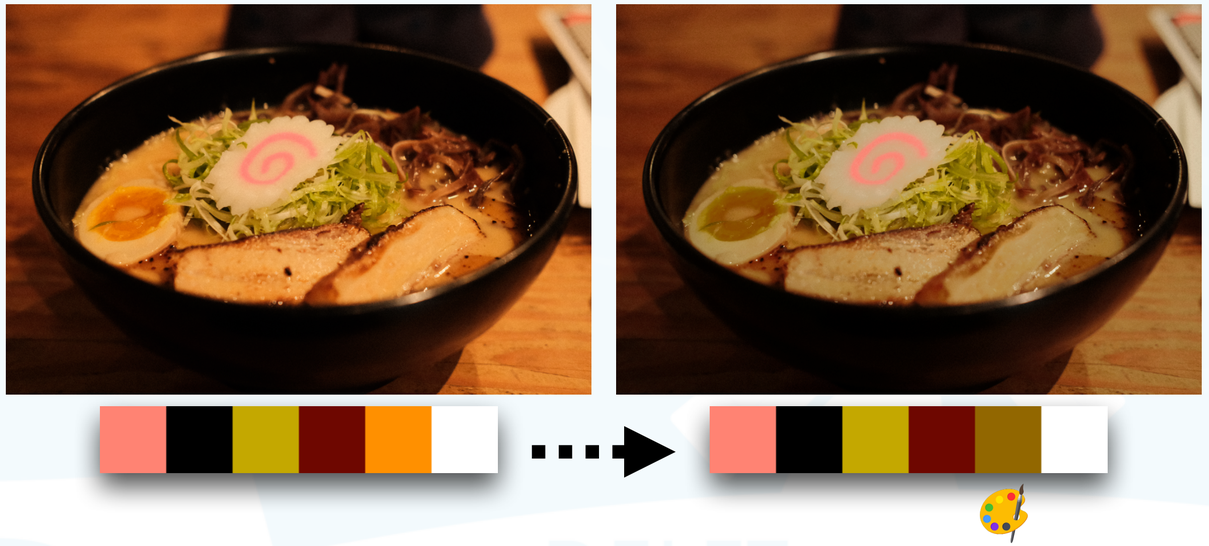

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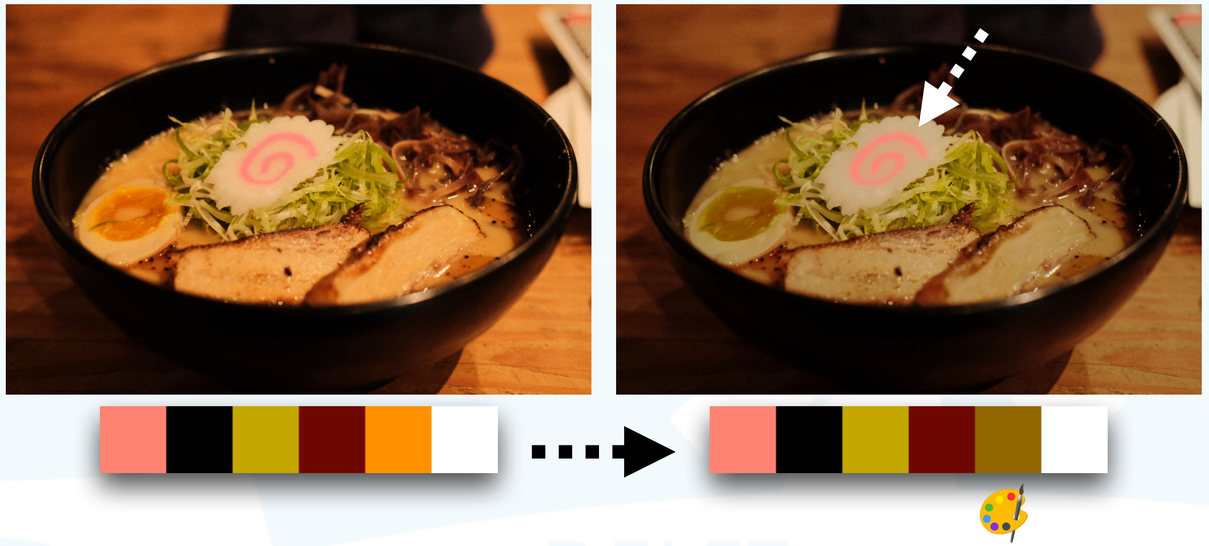

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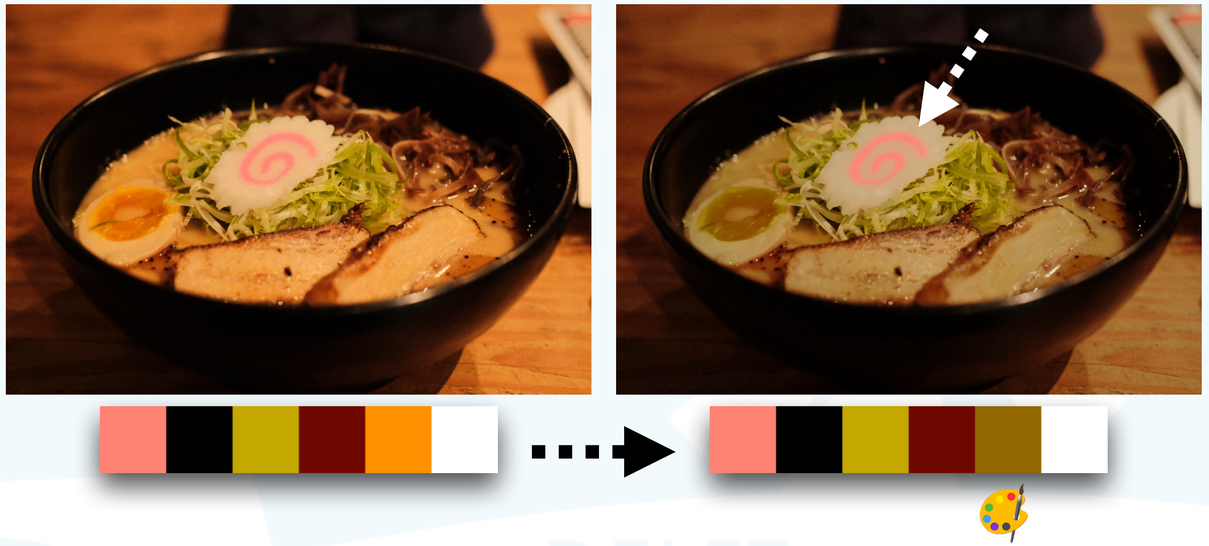

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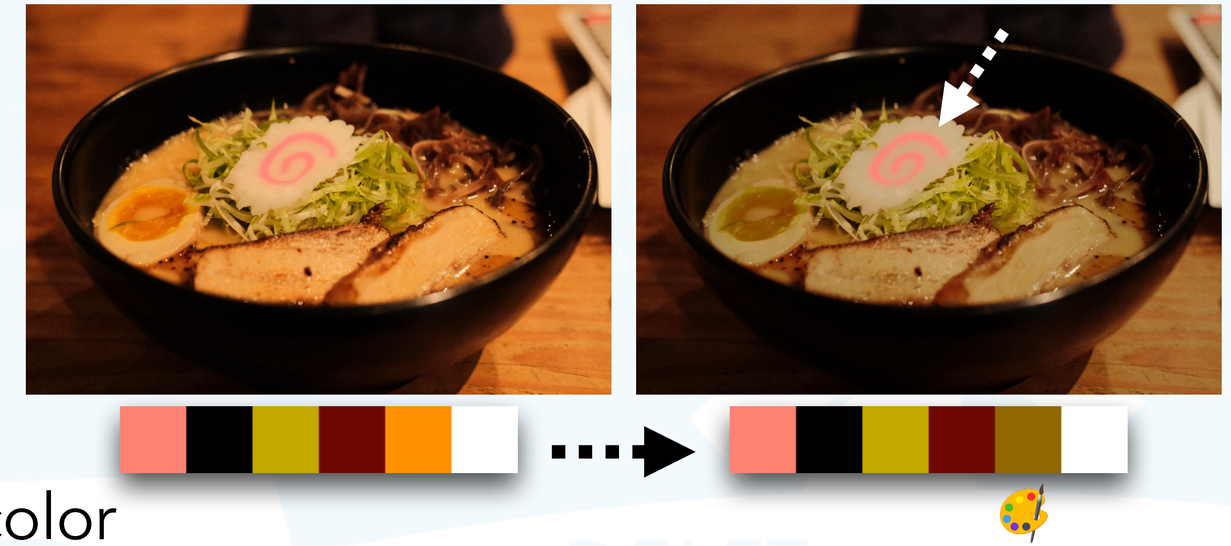

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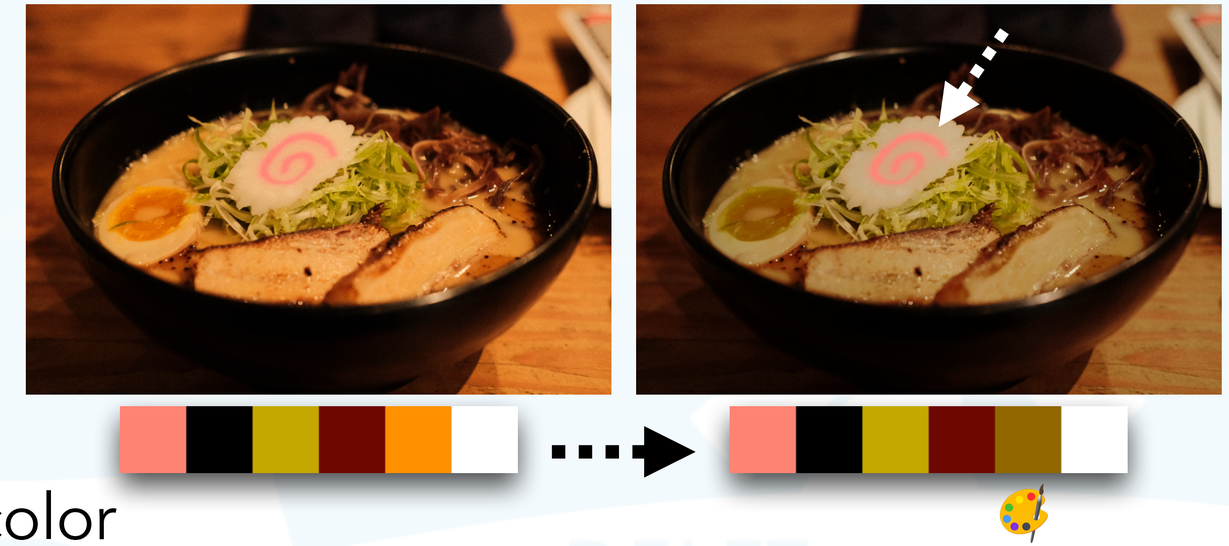

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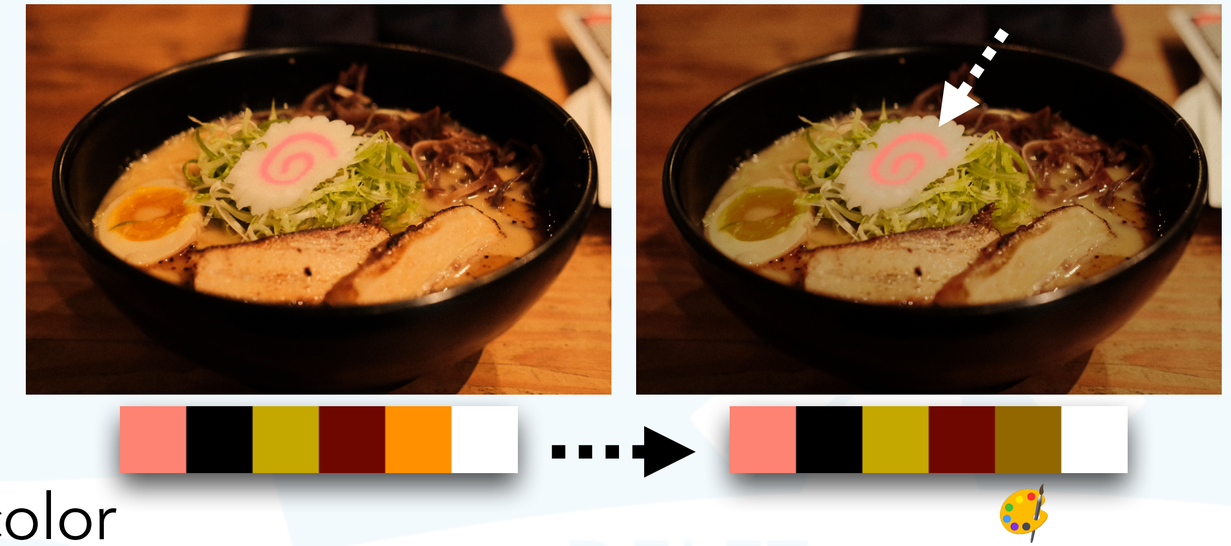

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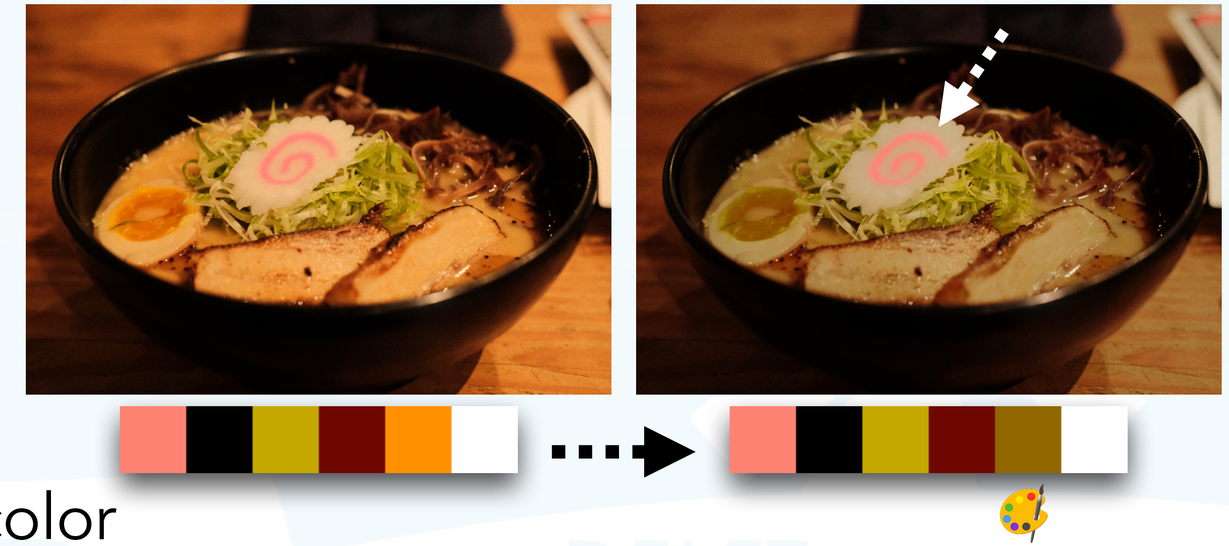

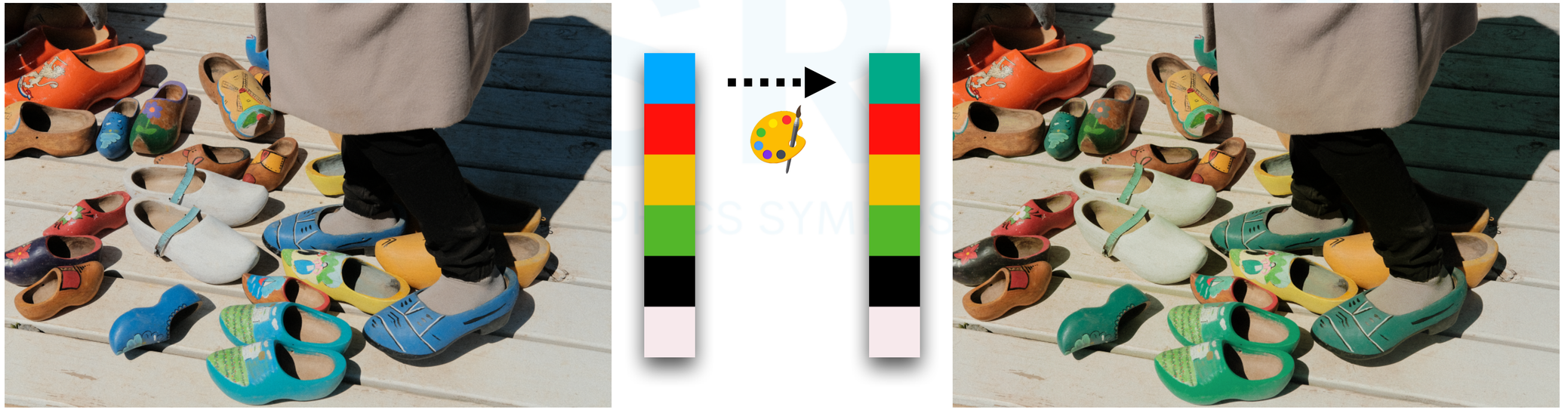

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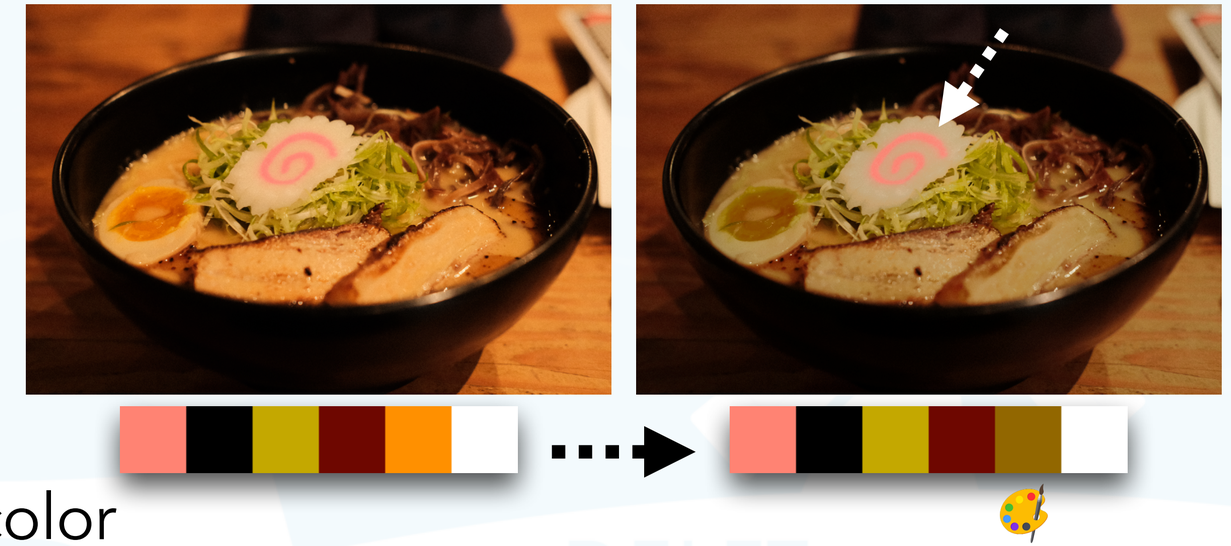

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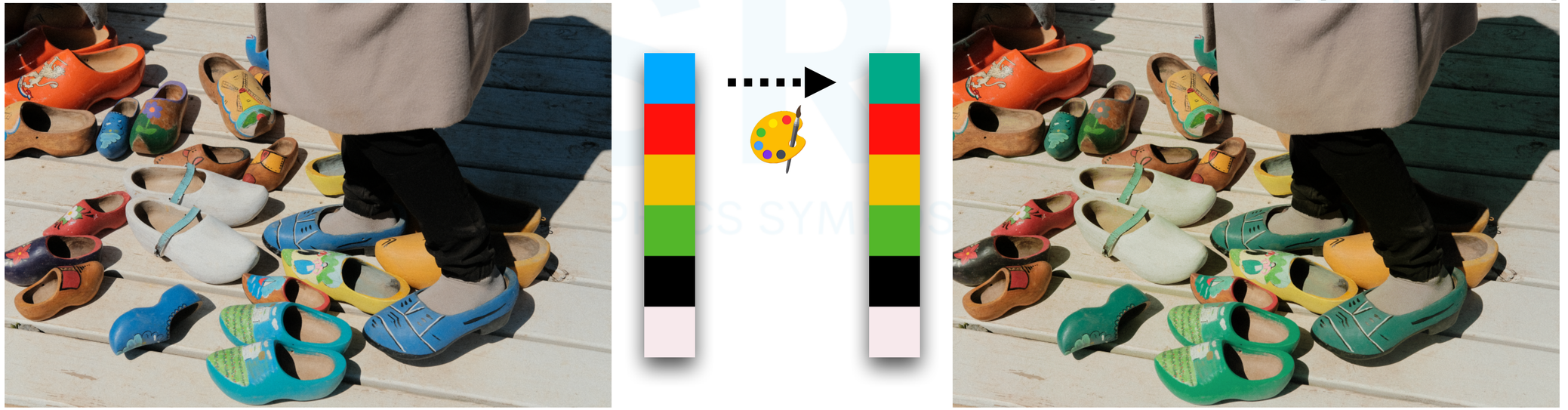

Our Workflow

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- Each edit needs to be applied in a sparse way
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Sparser Weights

Geometric Palette

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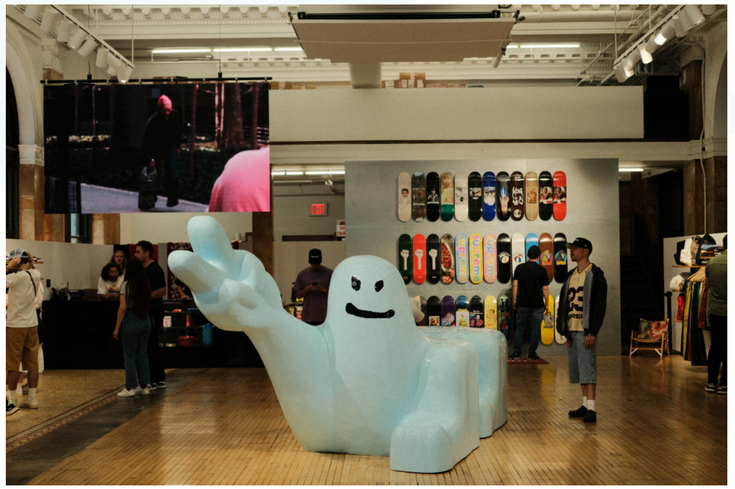
Image I



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RGB palette P

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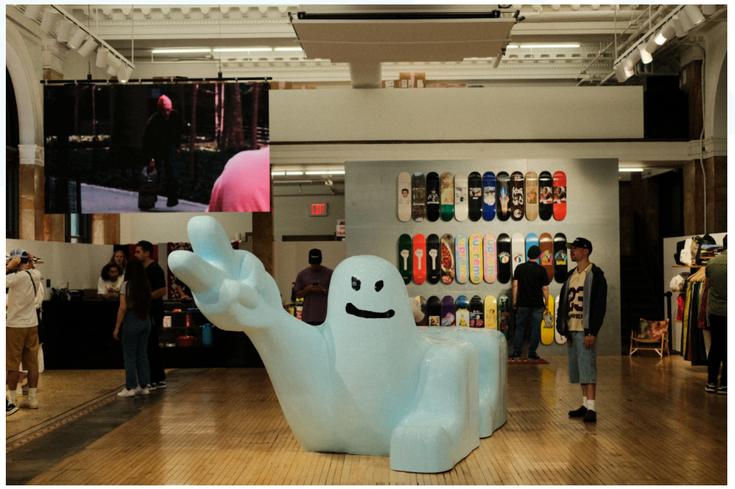

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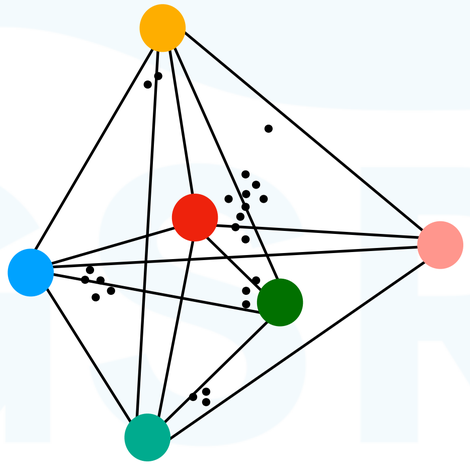

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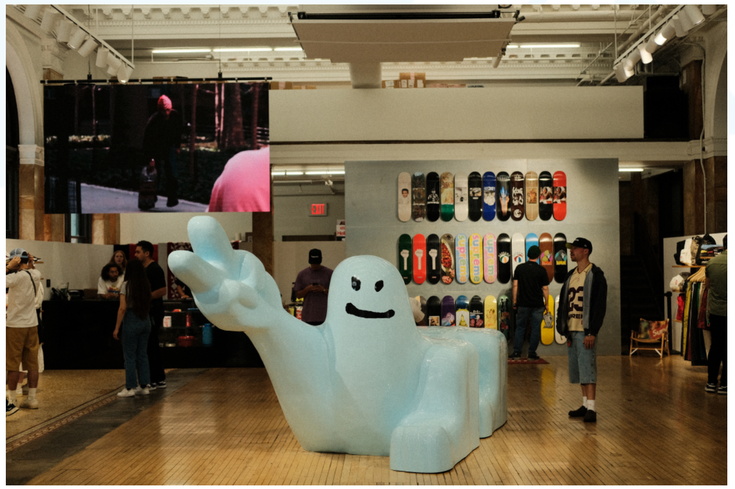

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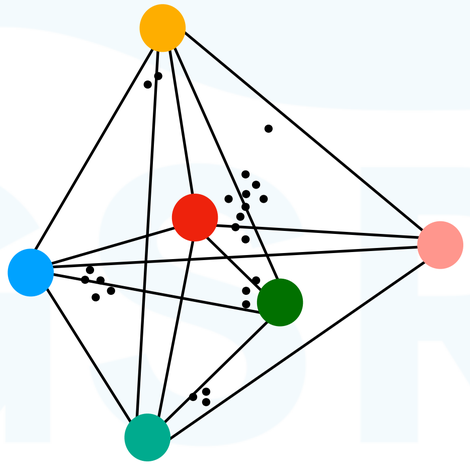

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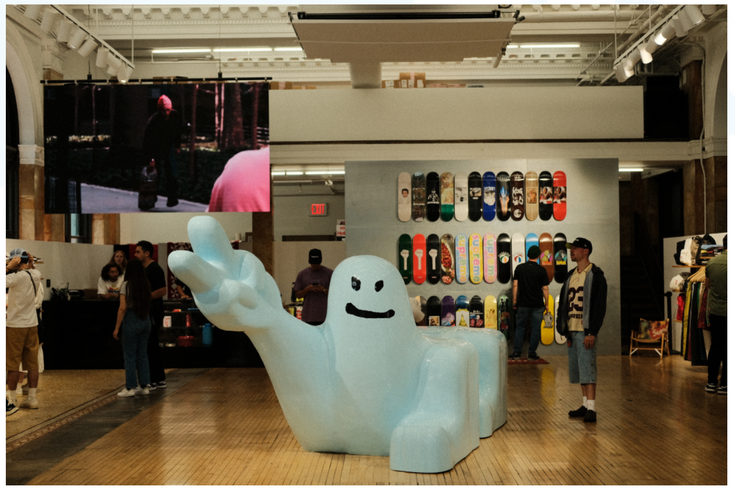

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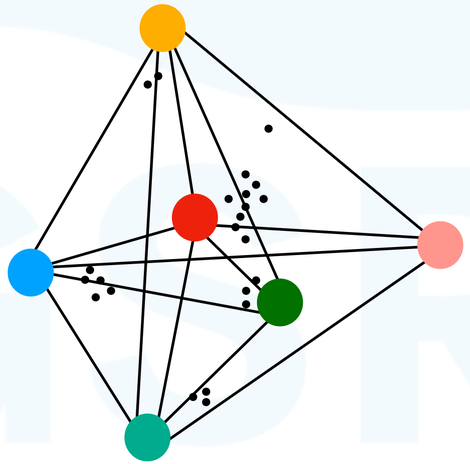

W_{RGBXY}

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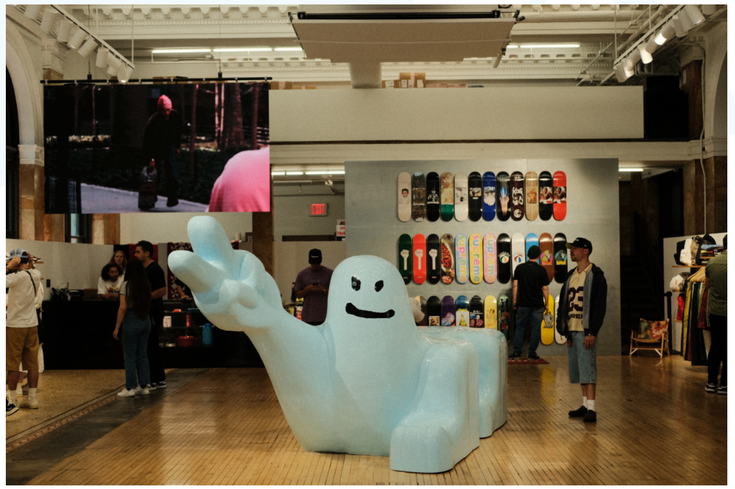

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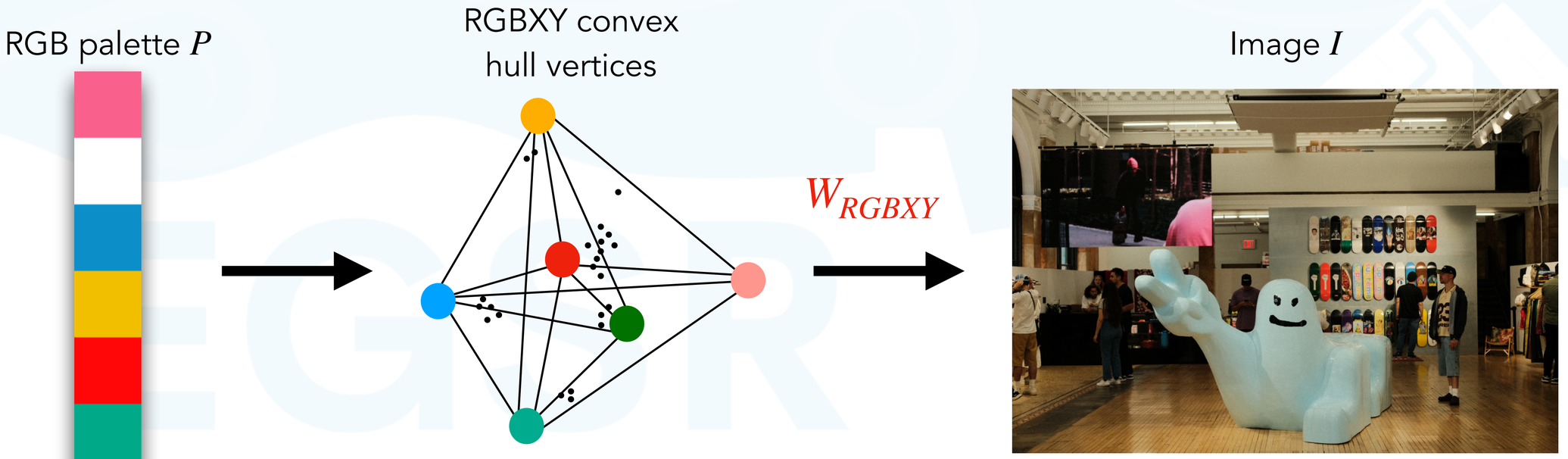

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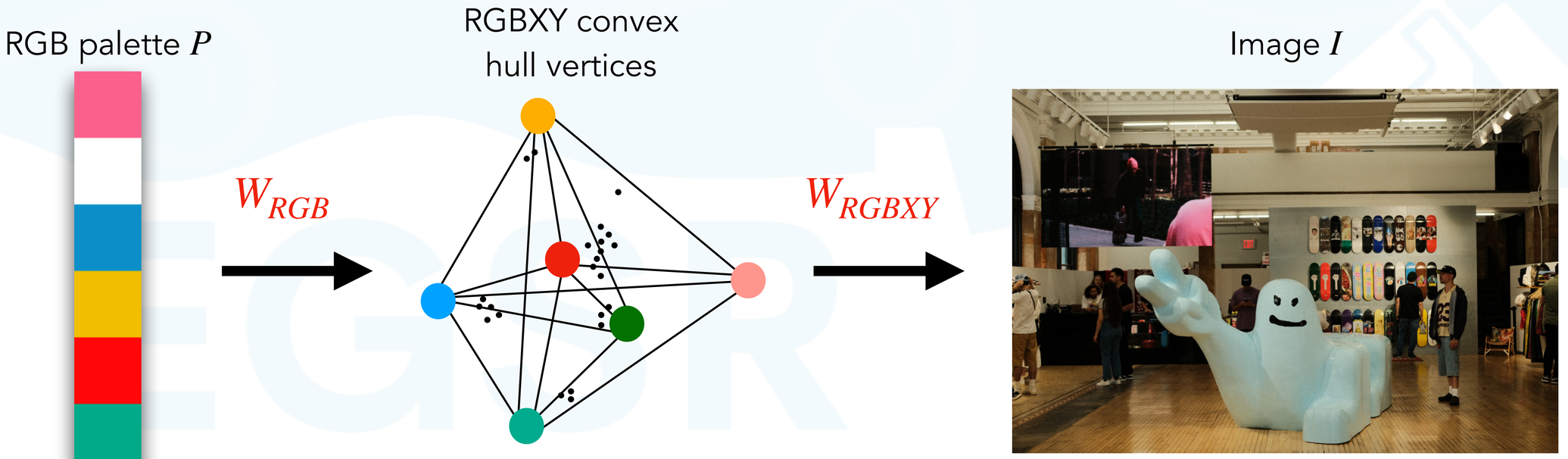

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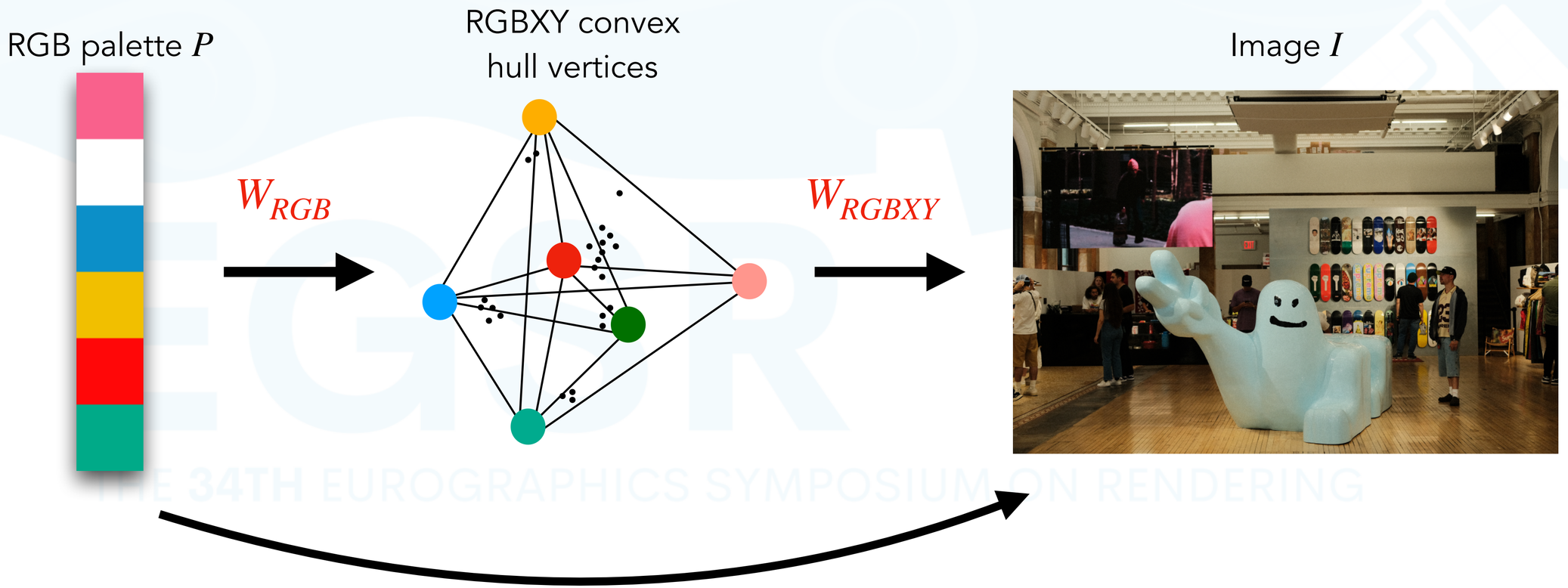

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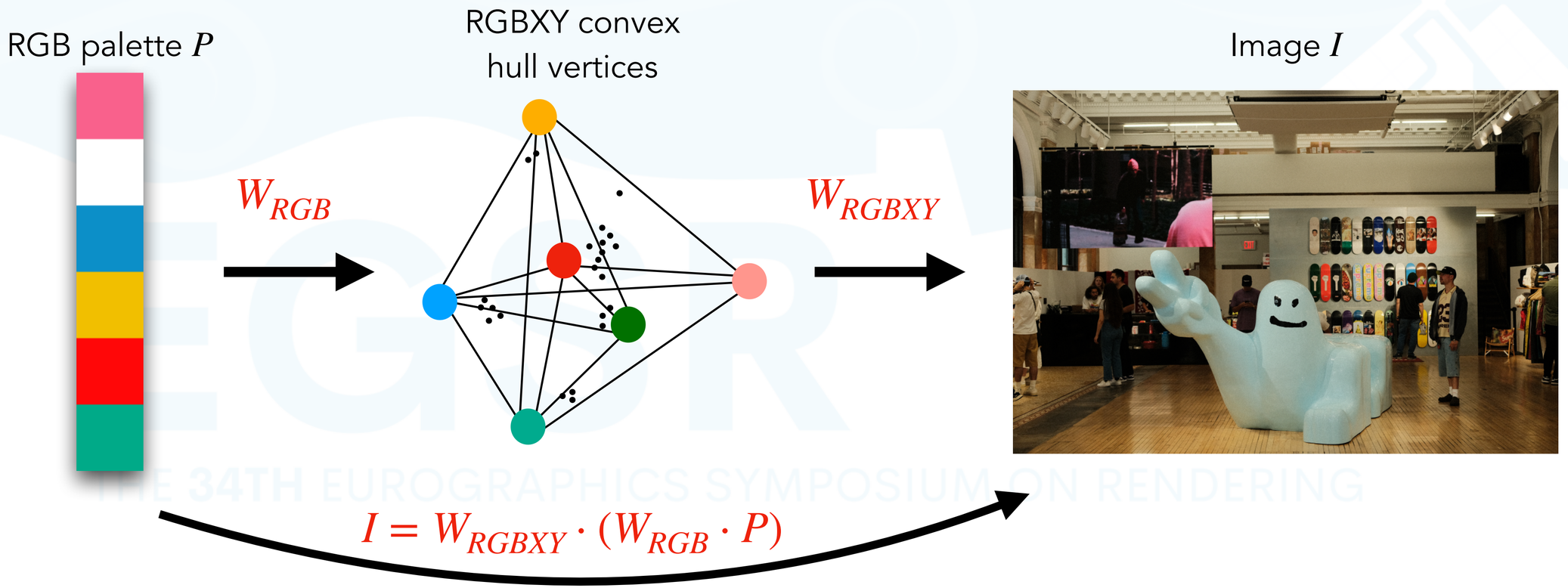

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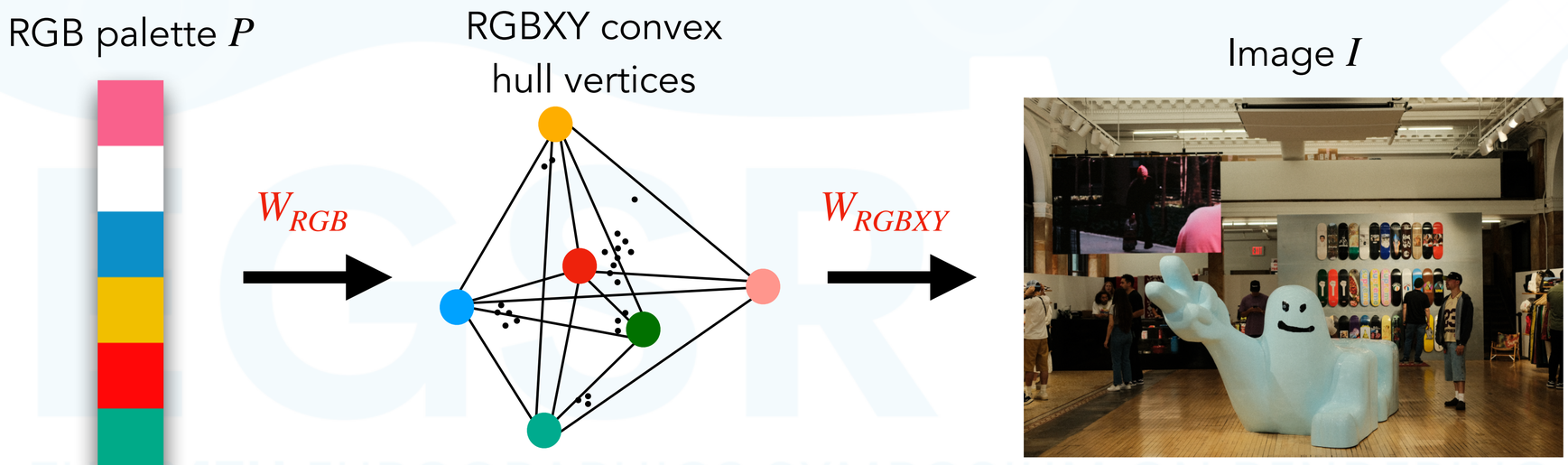

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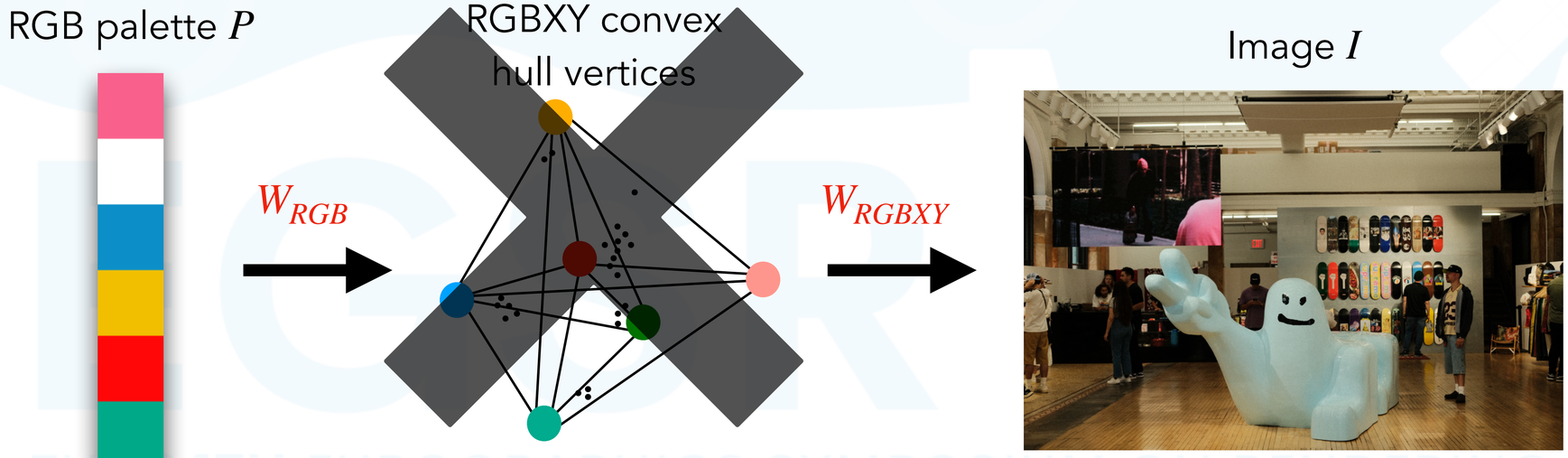

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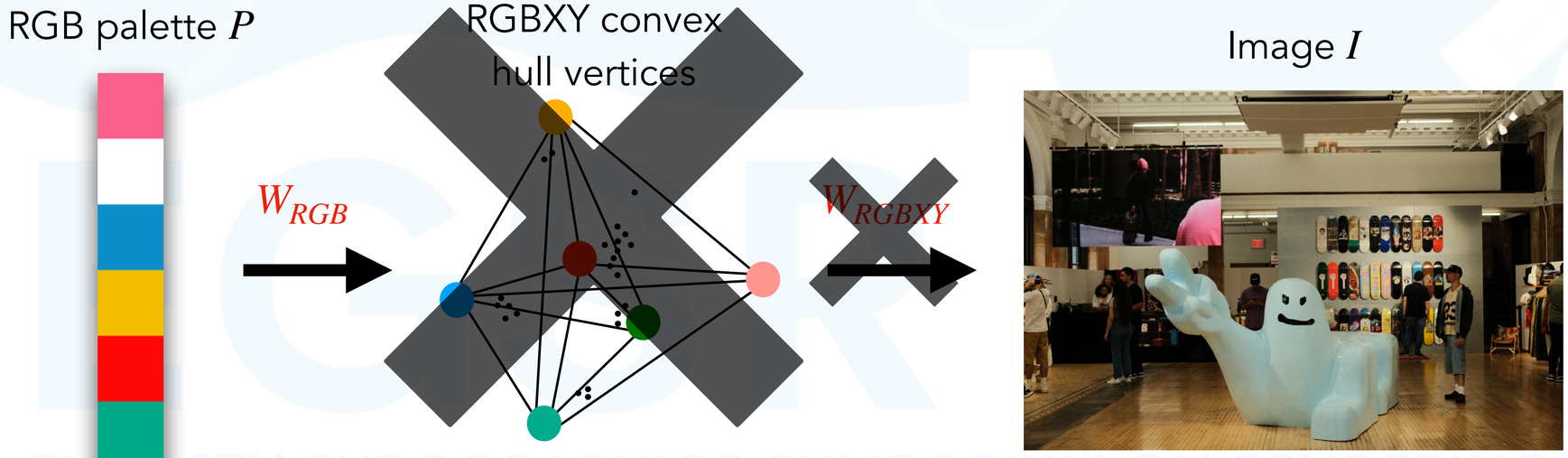

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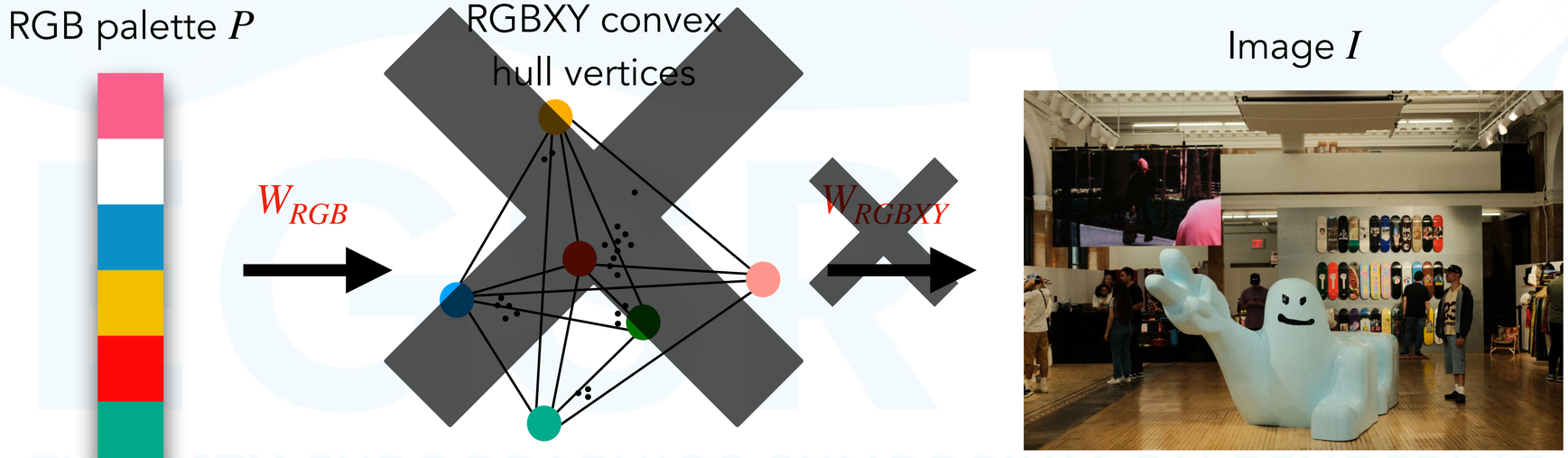

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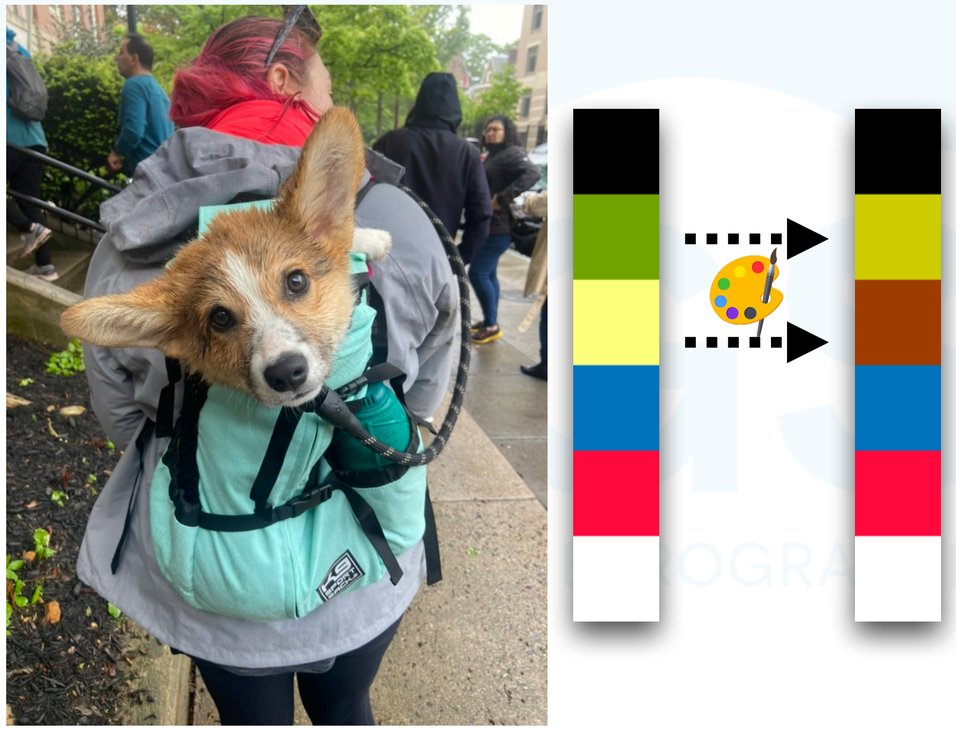

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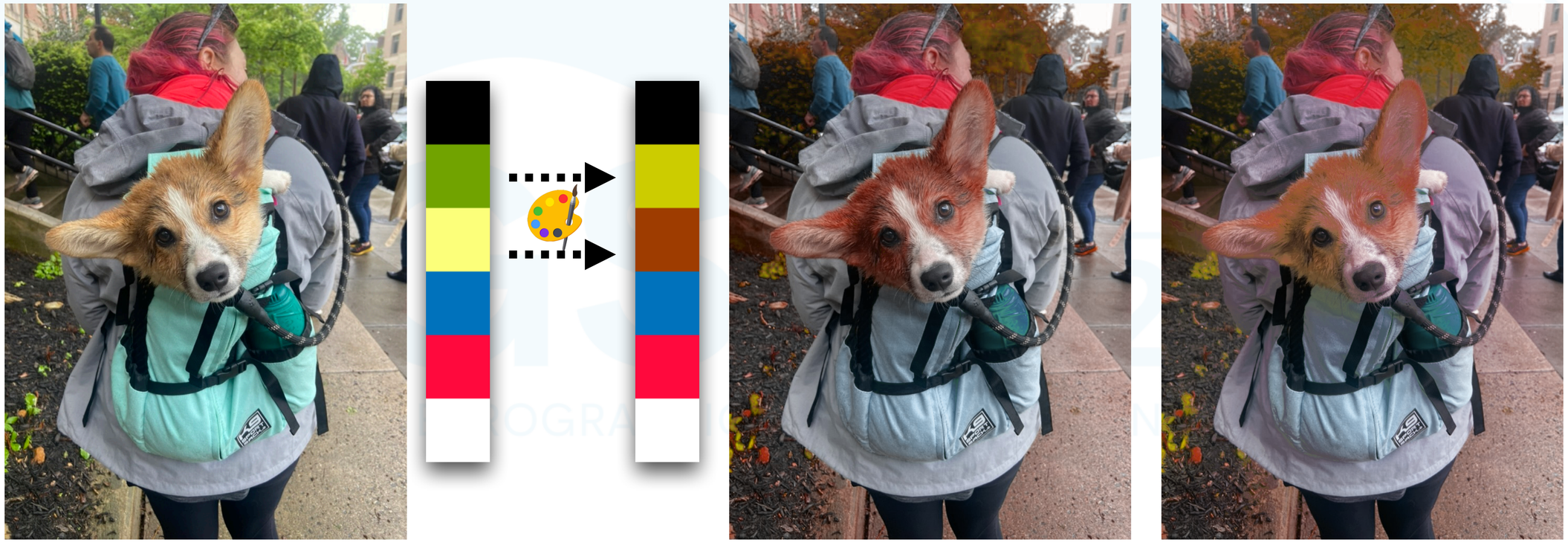

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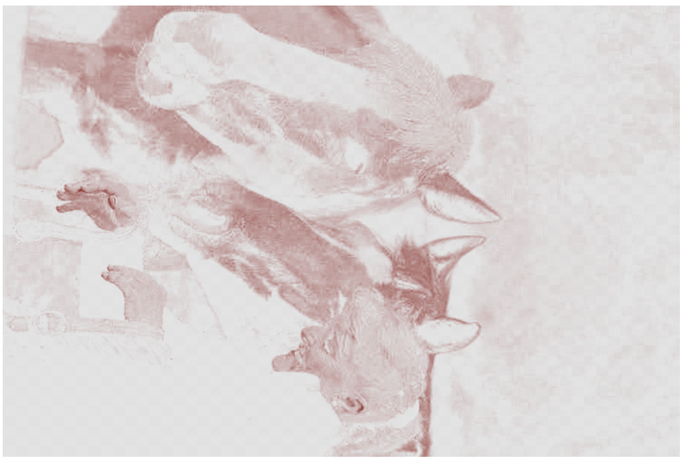

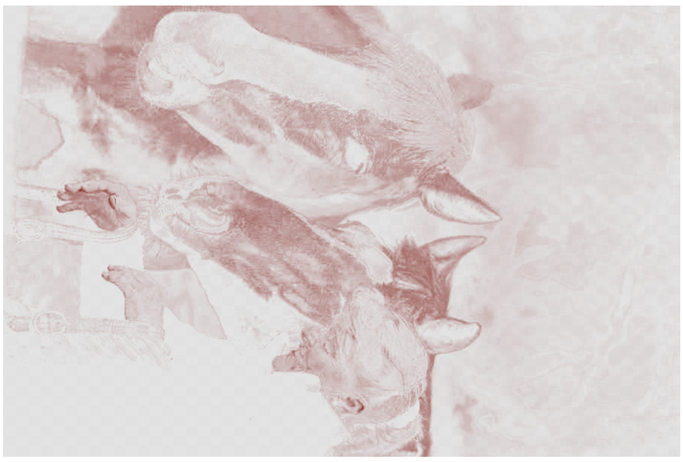

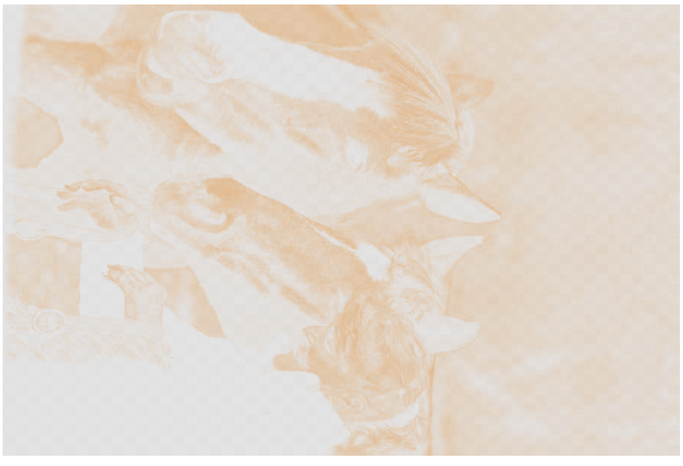

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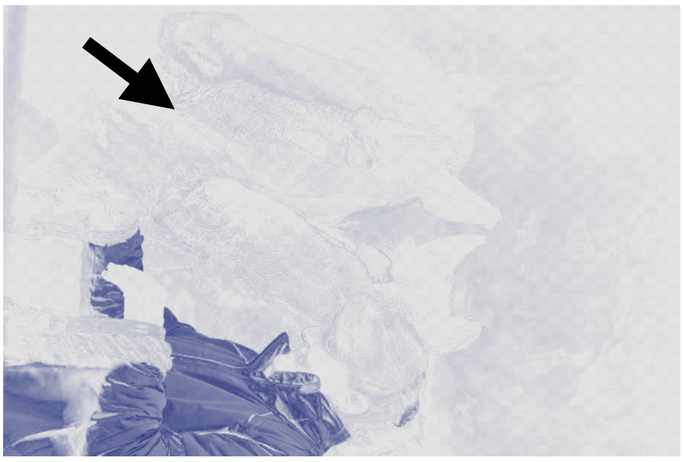

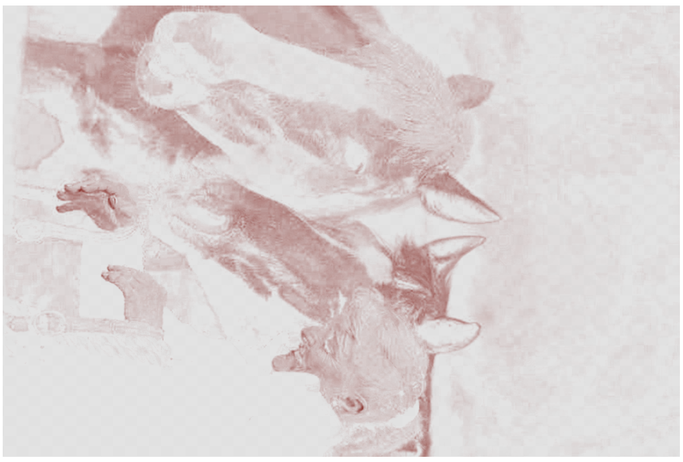

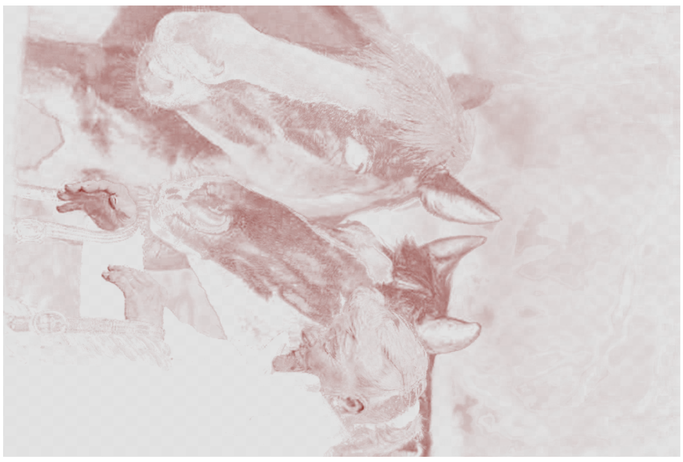

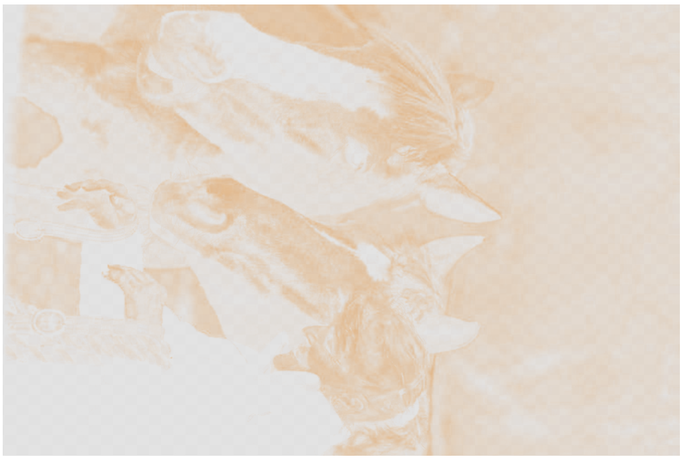

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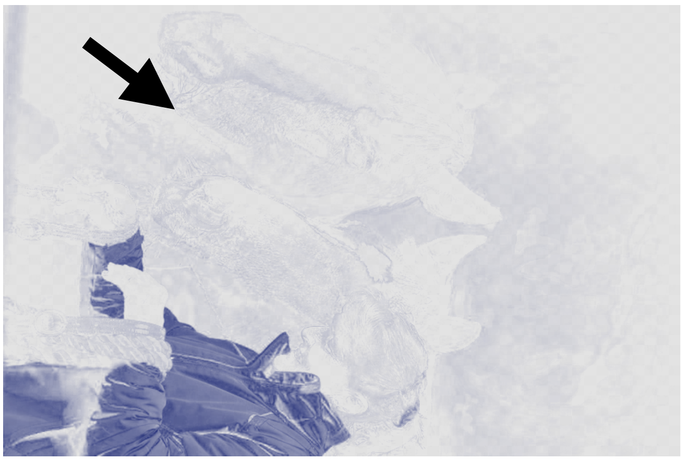

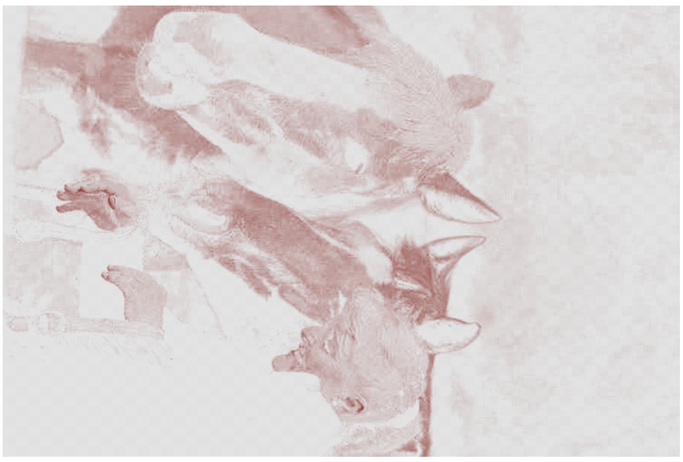

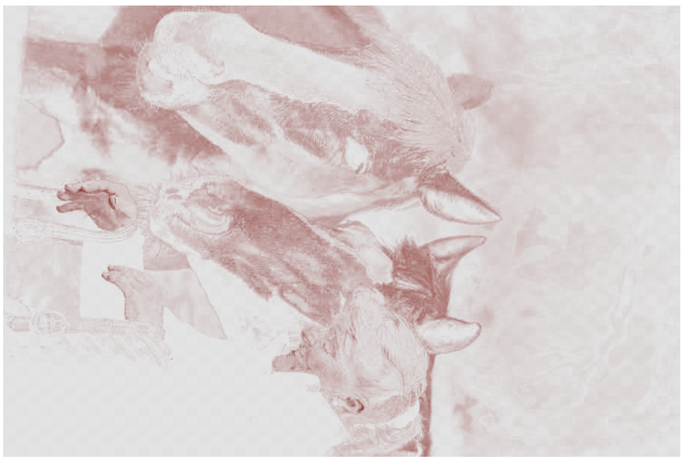

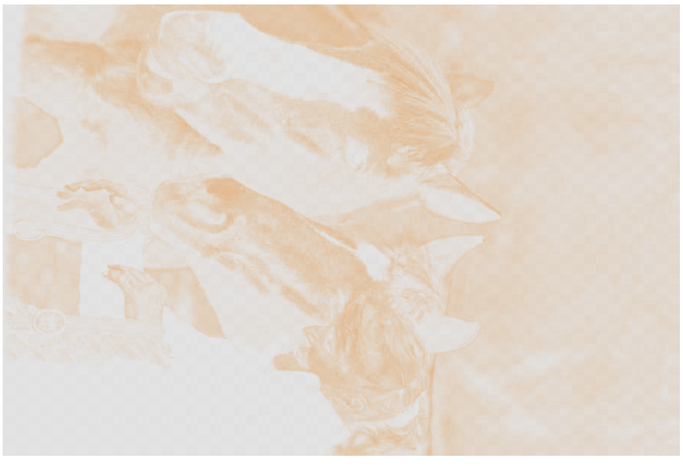

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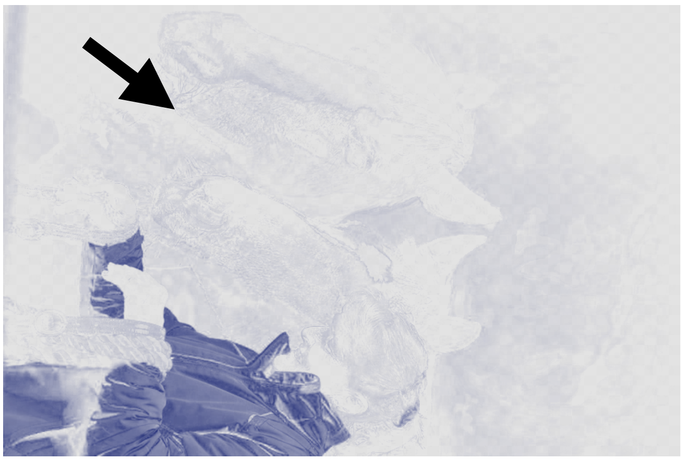

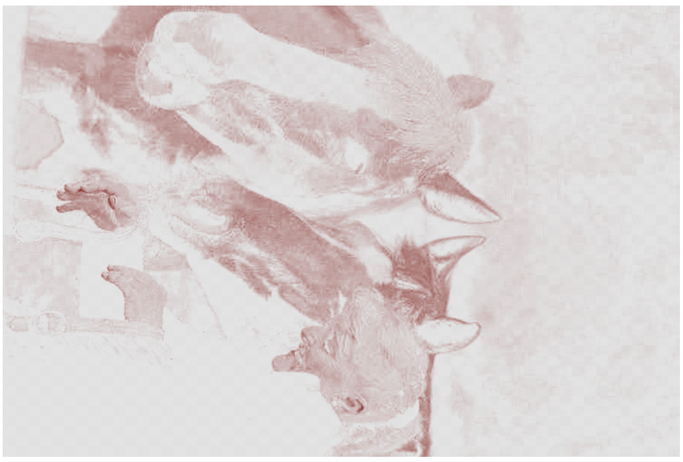

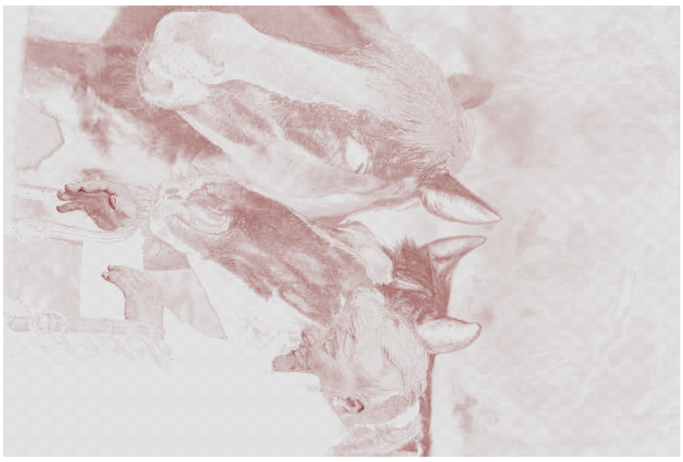

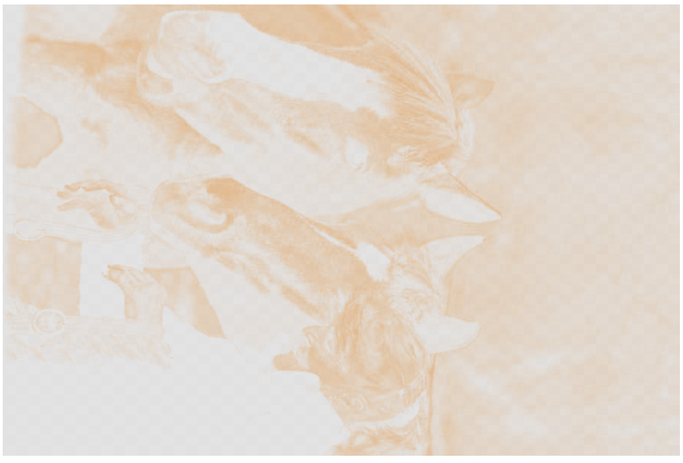

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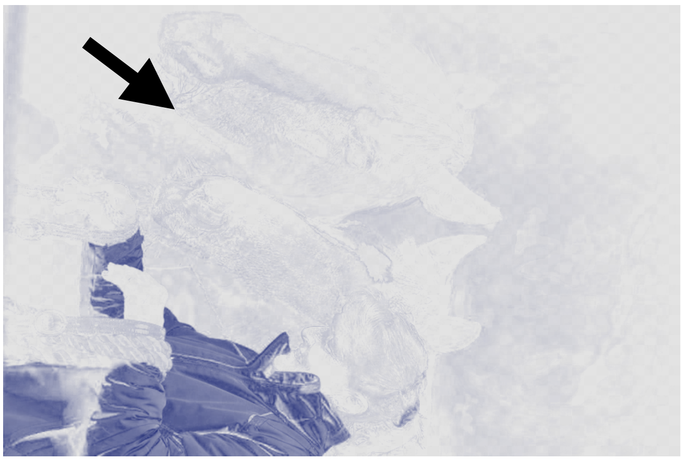

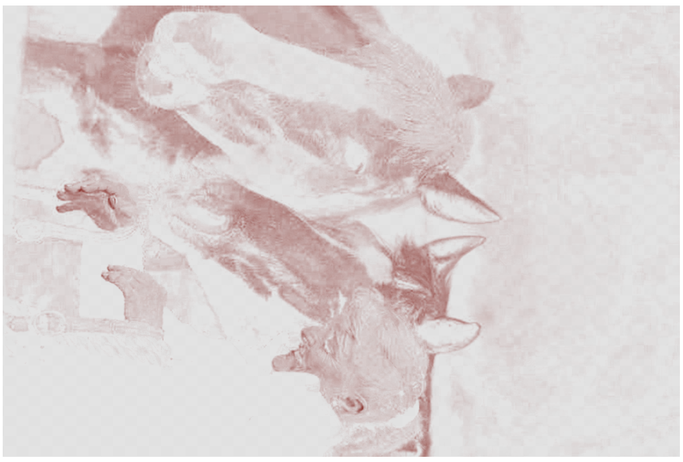

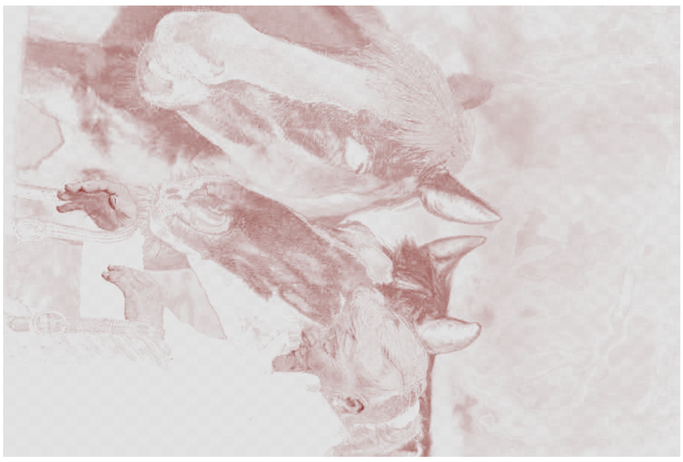

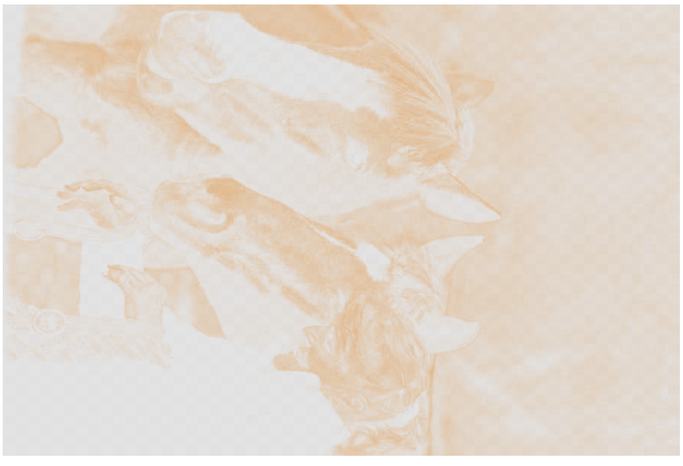

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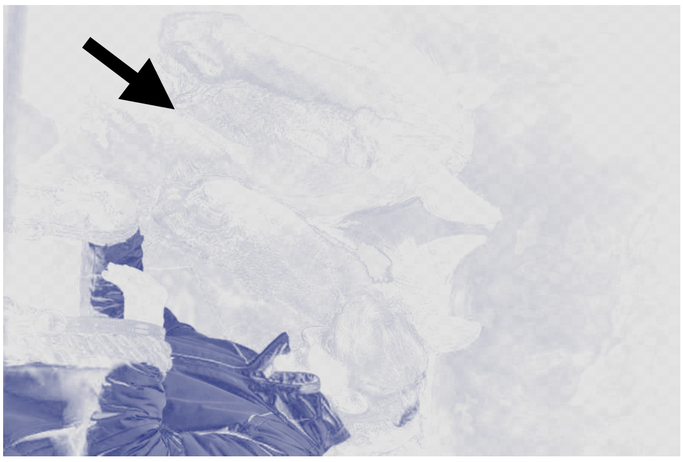

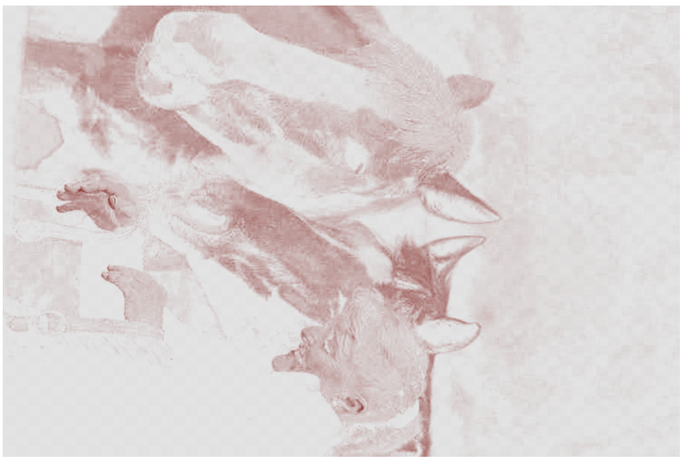

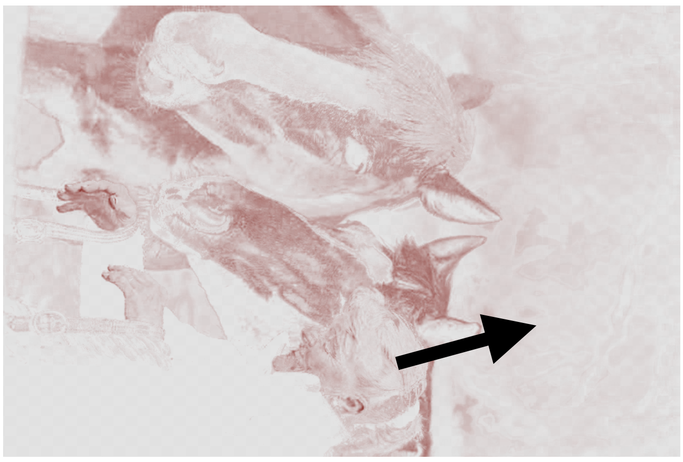

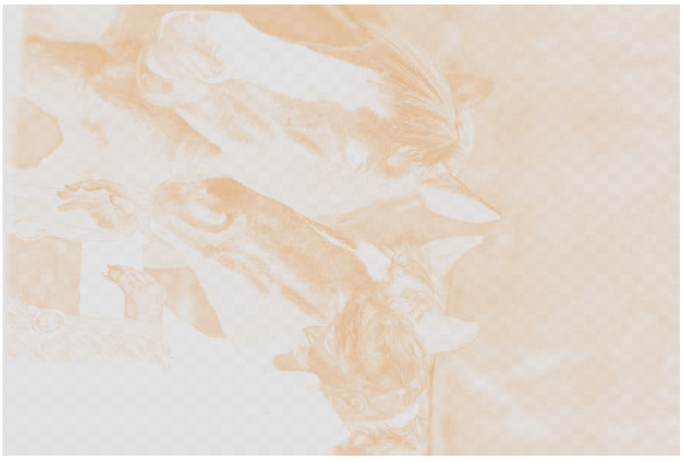

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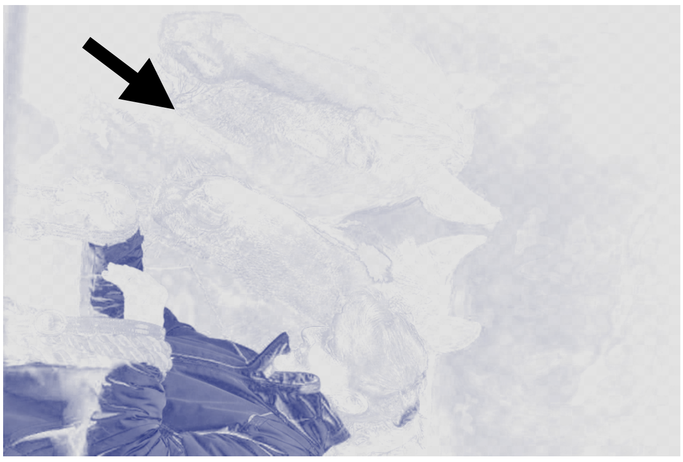

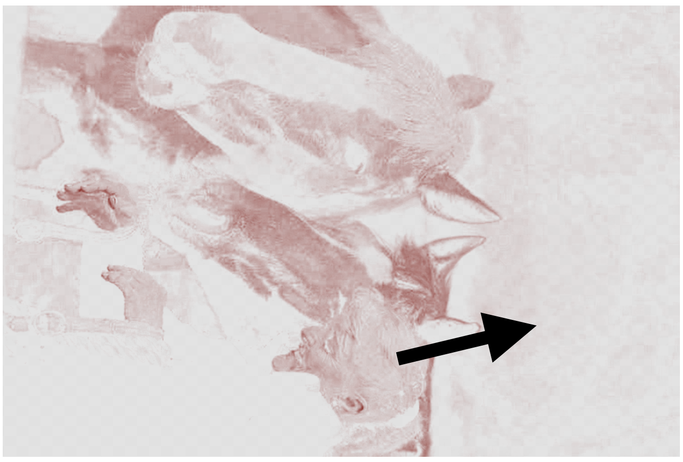

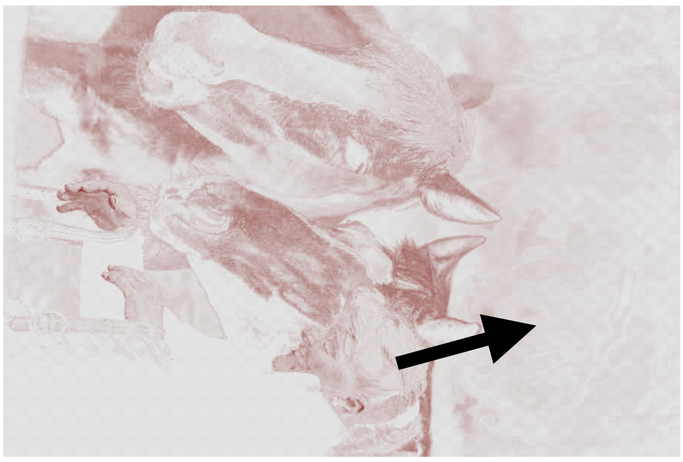

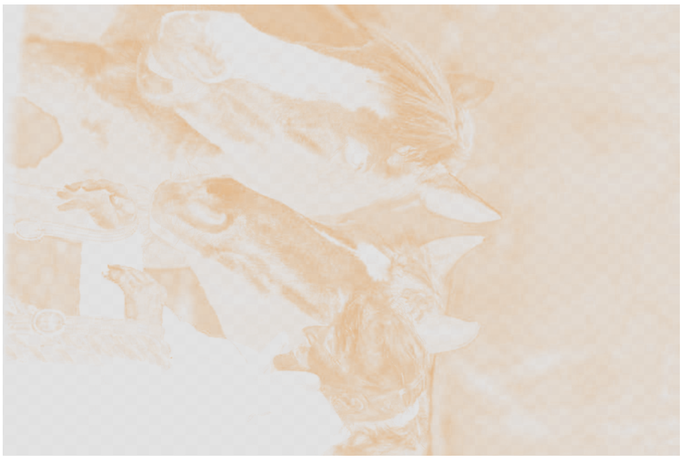

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EGSR

DELFT

2023

THE 34TH EUROGRAPHICS SYMPOSIUM ON RENDERING

Input

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[Tan et al. 2018]

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LoCoPalettes

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Local Control

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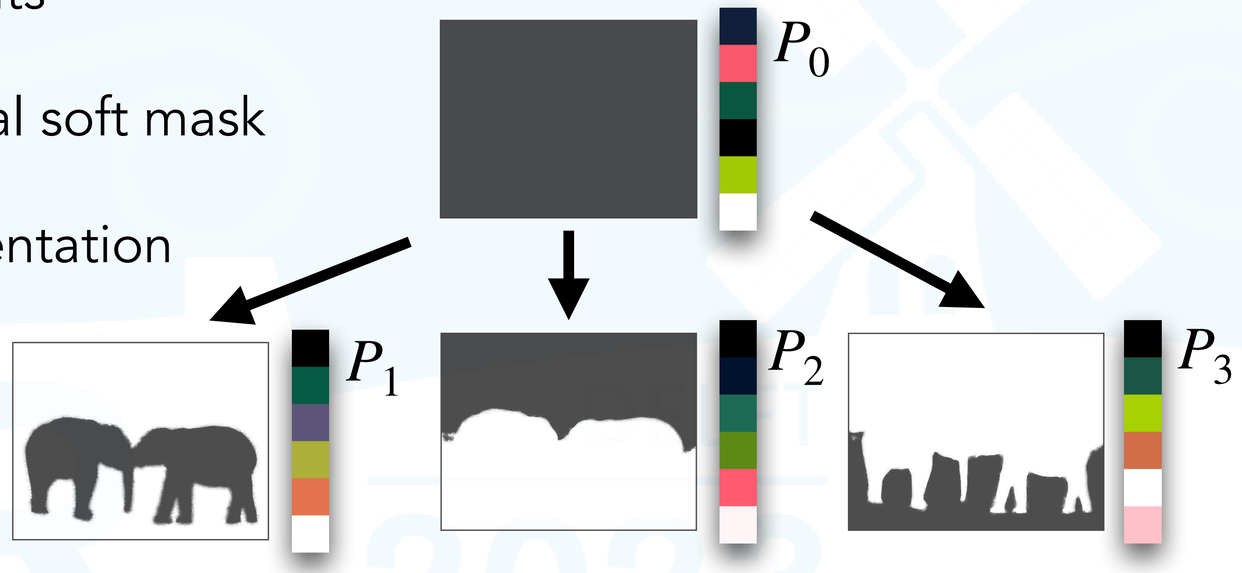

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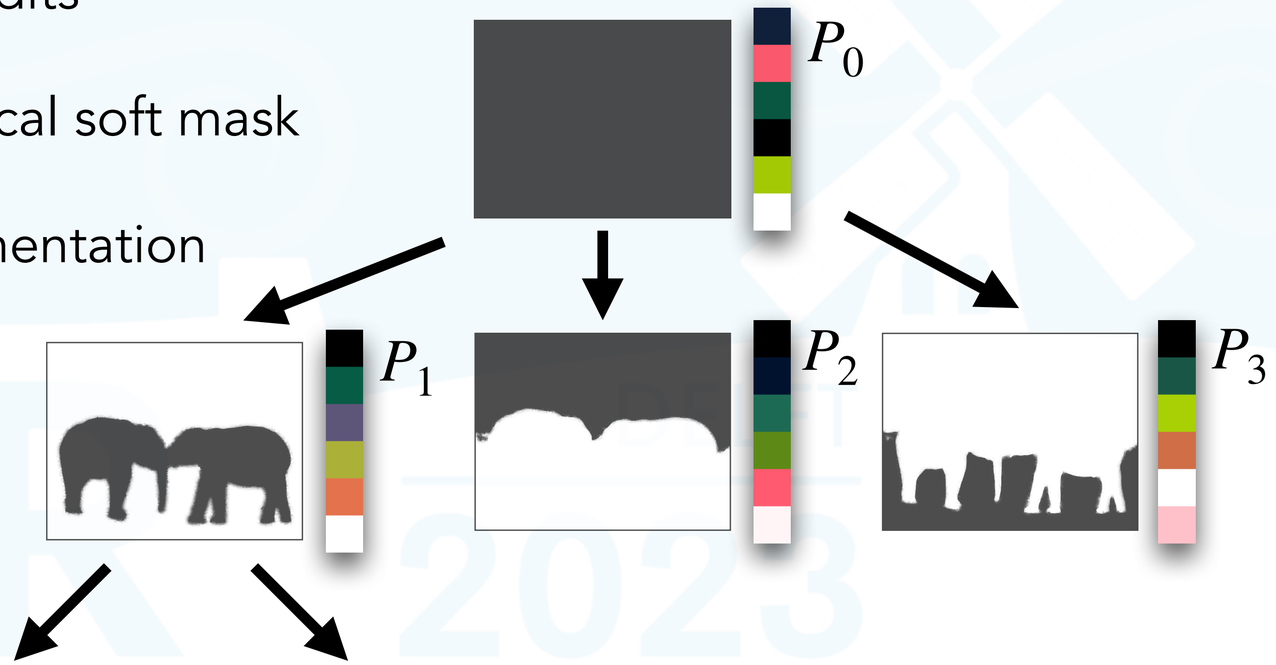

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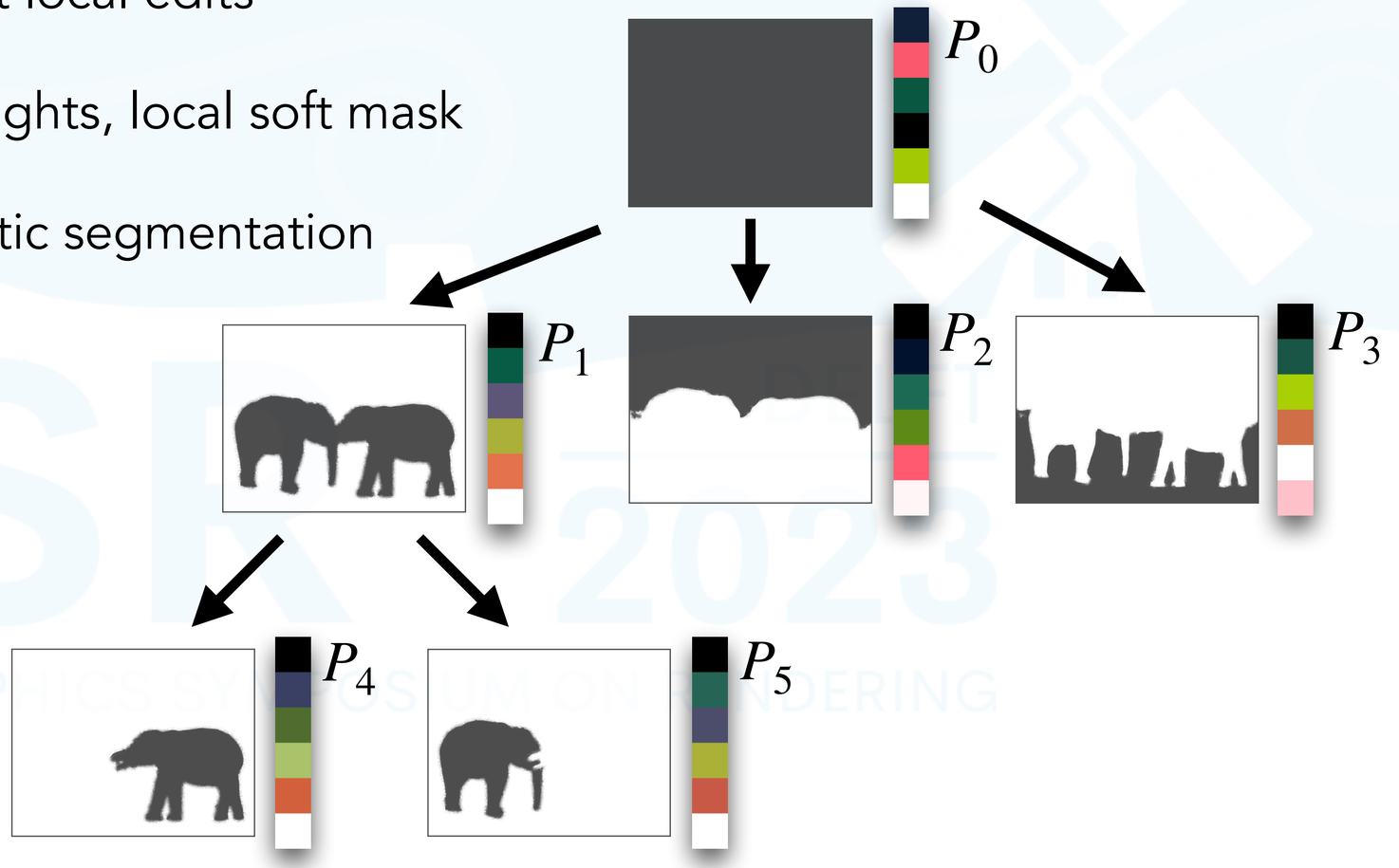
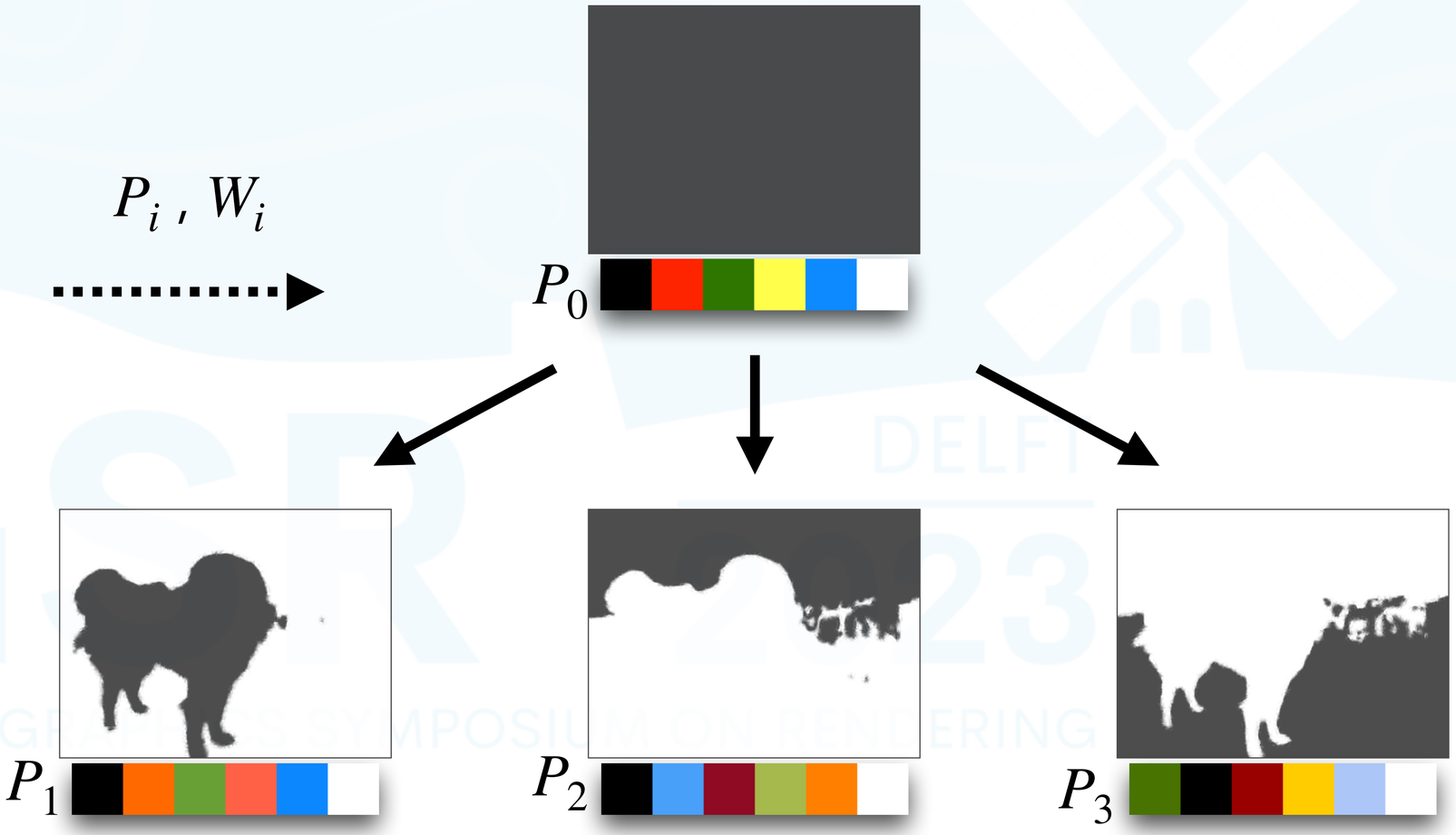


Editing Example

Image I

P_i , W_i



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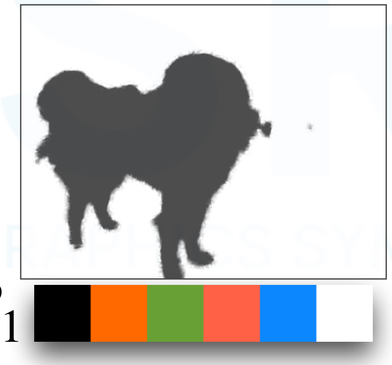

P_1

P_2

P_3

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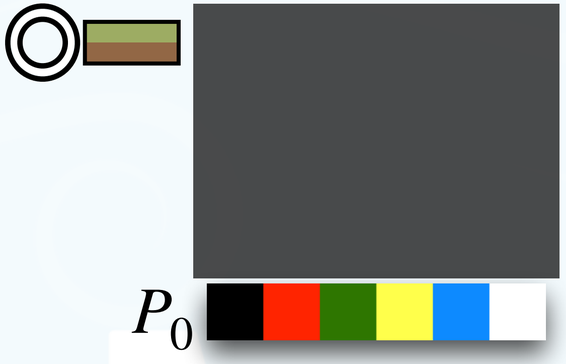
Image I

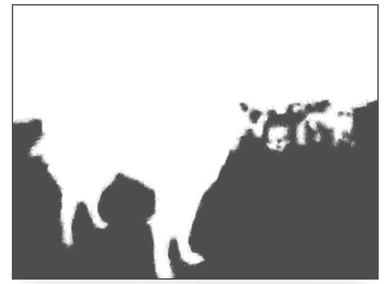
P_i , W_i



P_0

P_1

P_2



P_3

Editing Example

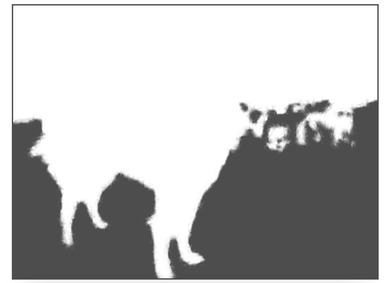
Image I

P_i , W_i

P_0

P_1

P_2



P_3

Editing Example

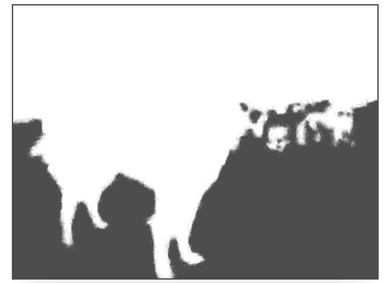
Image I

P_i , W_i

P_0

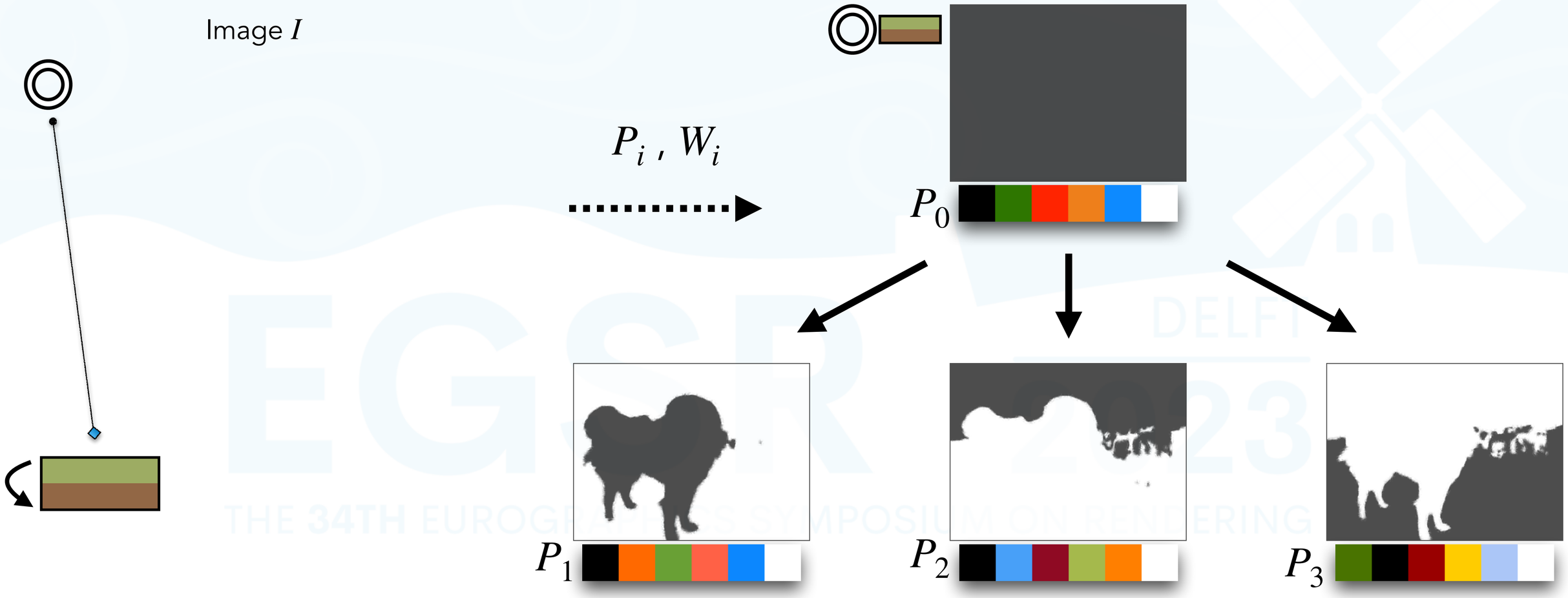
P_1

P_2



P_3

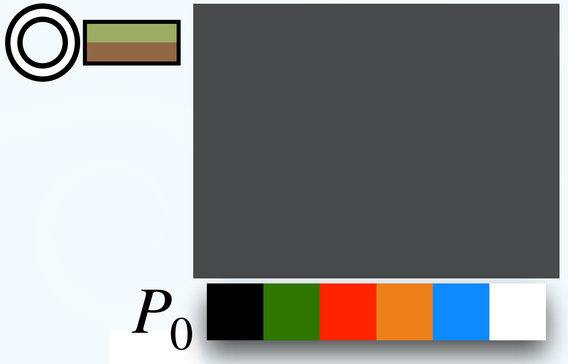
Editing Example



Editing Example

Image I

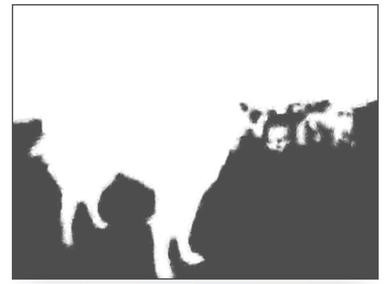
P_i , W_i



P_0

P_1

P_2

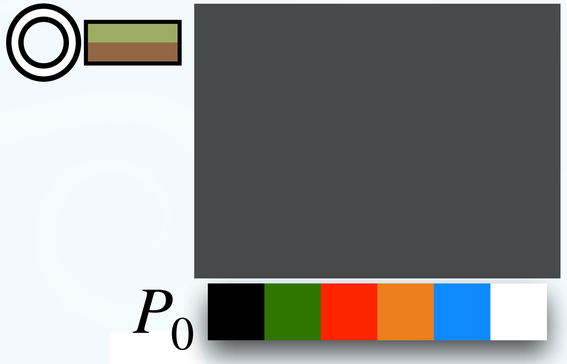


P_3

Editing Example

Image I

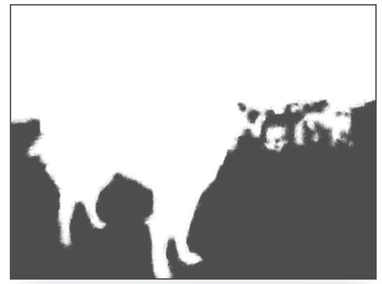
P_i , W_i



P_0

P_1

P_2

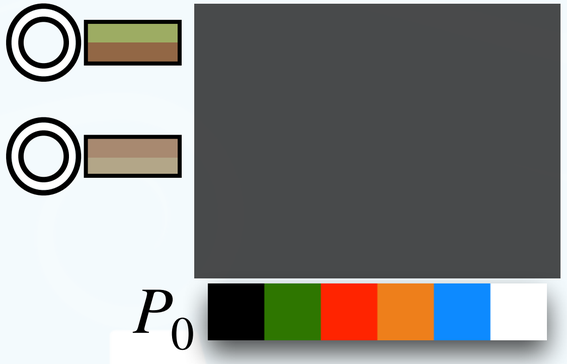


P_3

Editing Example

Image I

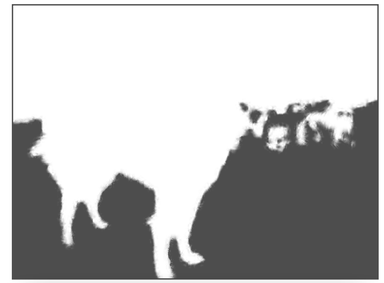
P_i , W_i



P_0

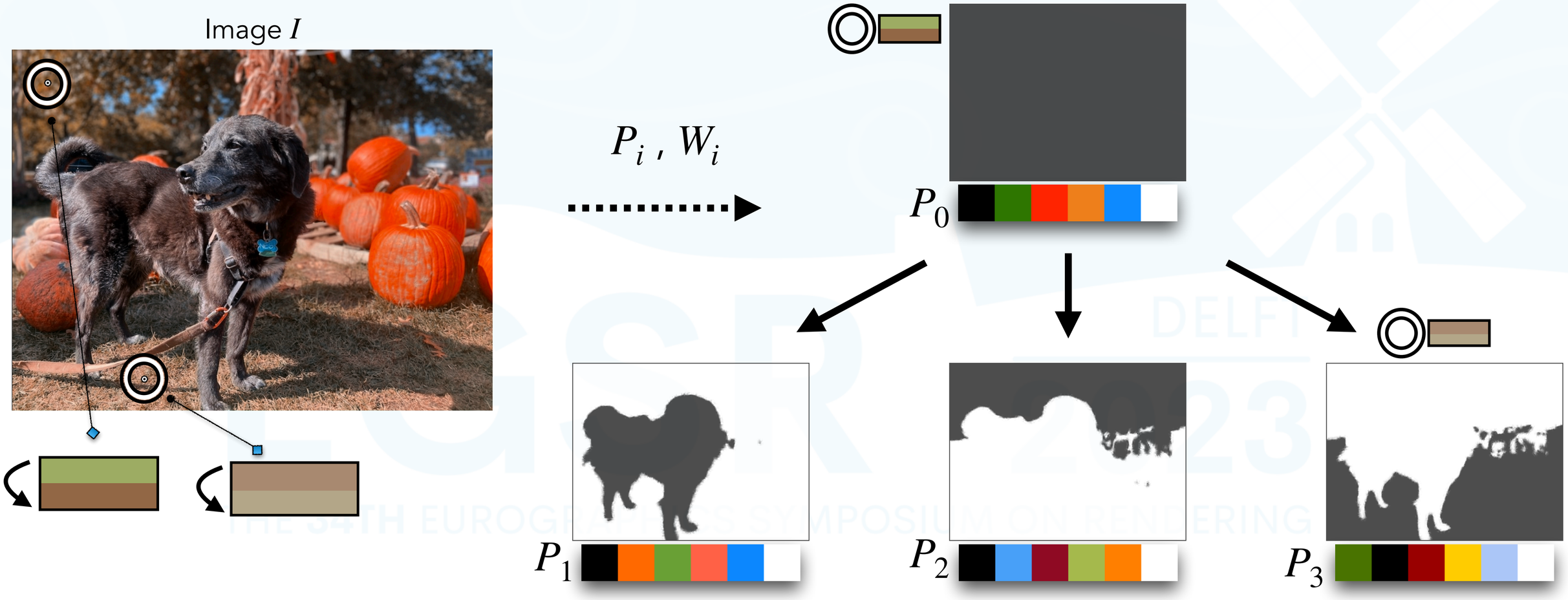
P_1

P_2



P_3

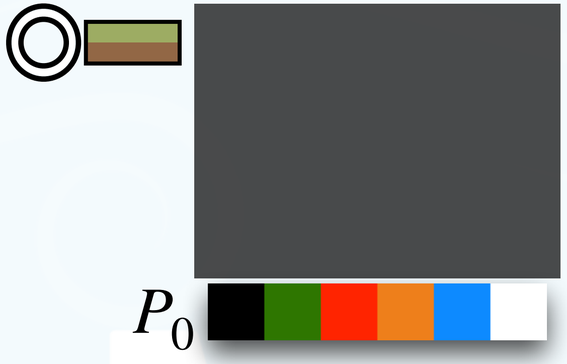
Editing Example



Editing Example

Image I

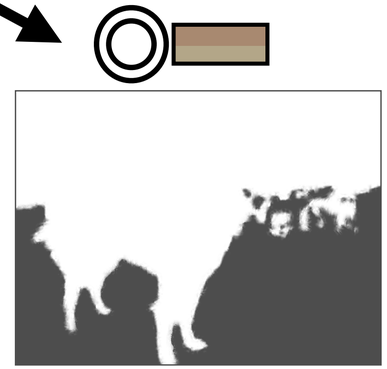
P_i , W_i



P_0

P_1

P_2

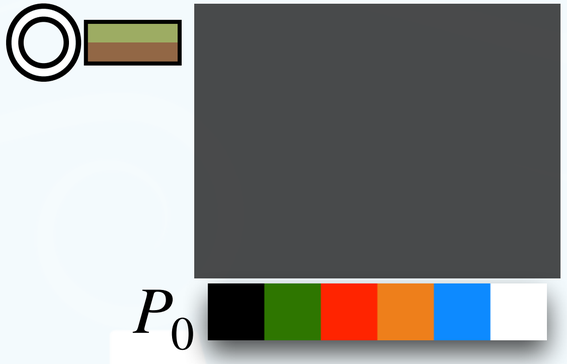


P_3

Editing Example

Image I

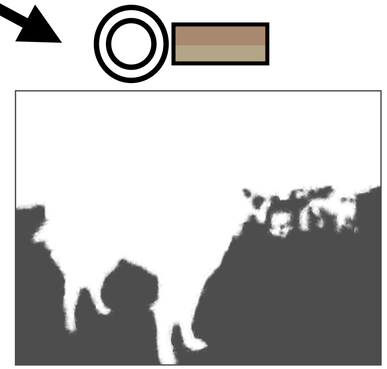
P_i , W_i



P_0

P_1

P_2

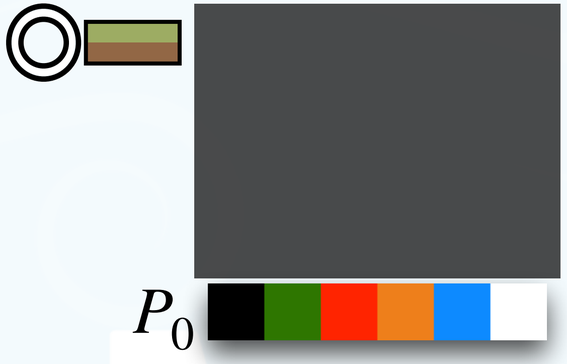


P_3

Editing Example

Image I

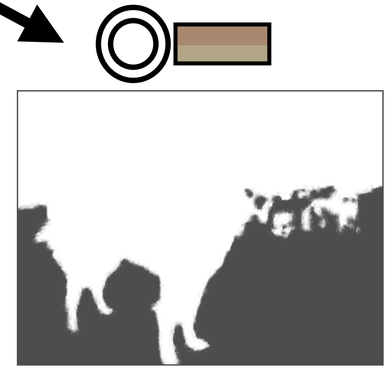
P_i , W_i



P_0

P_1

P_2

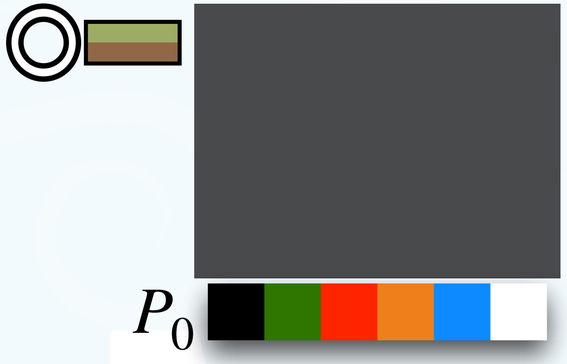


P_3

Editing Example

Image I

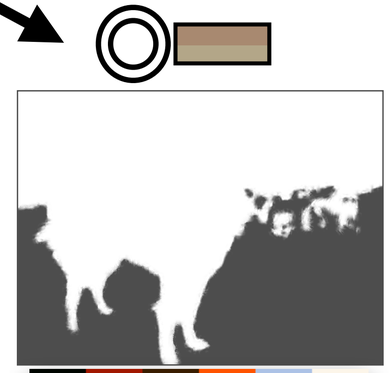
P_i , W_i



P_0

P_1

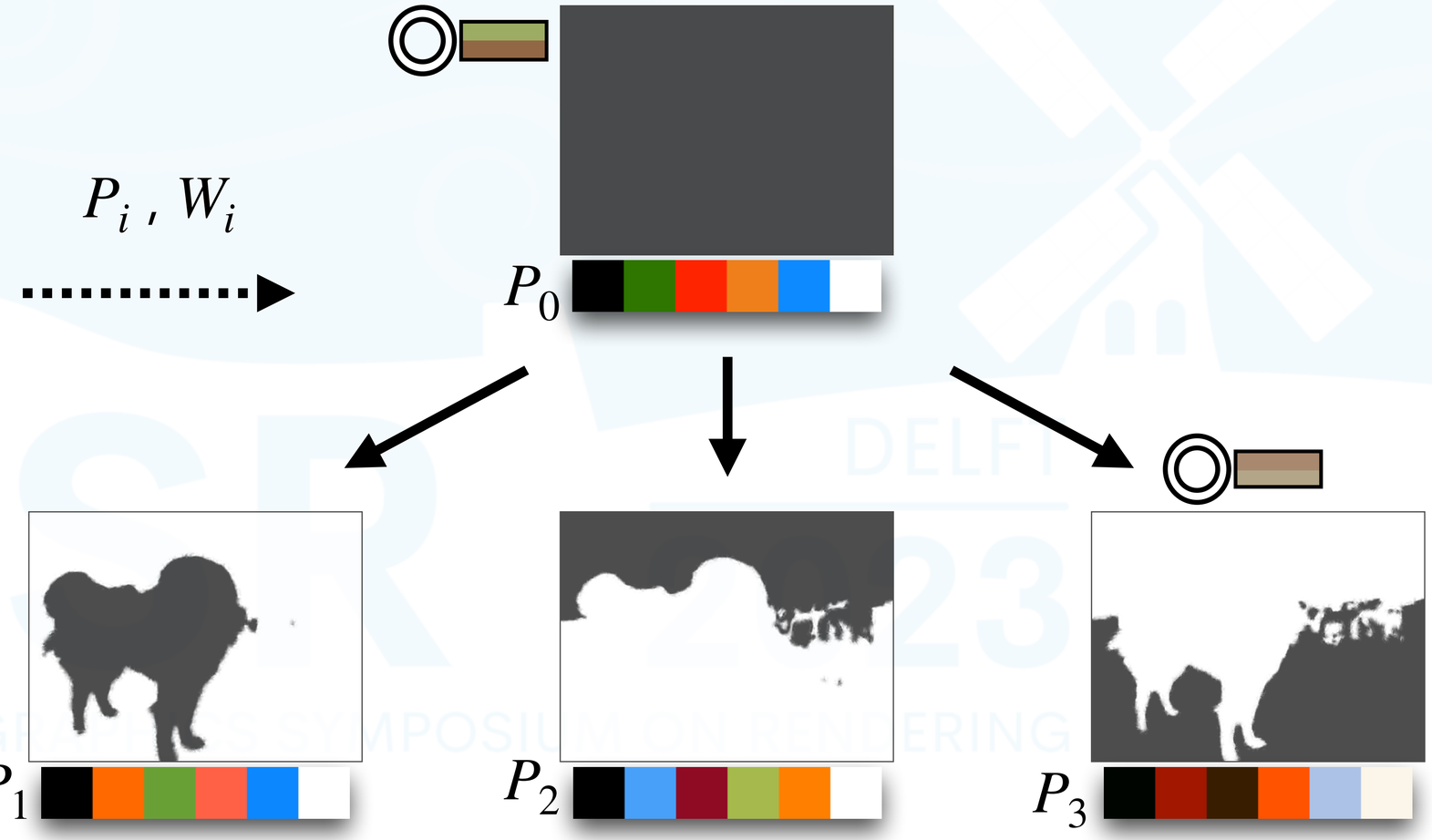
P_2



P_3

Editing Example

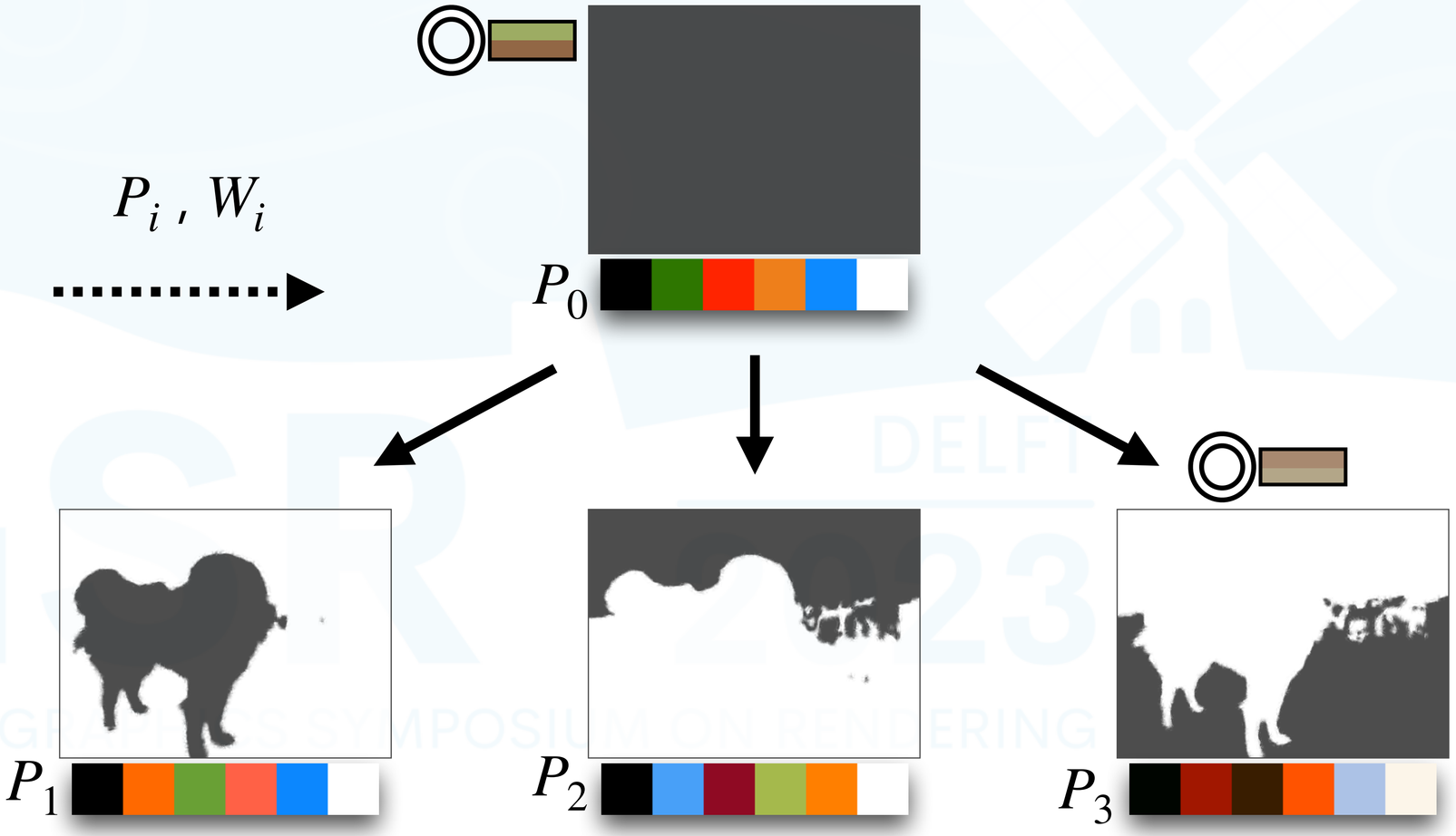
Image I



Editing Example

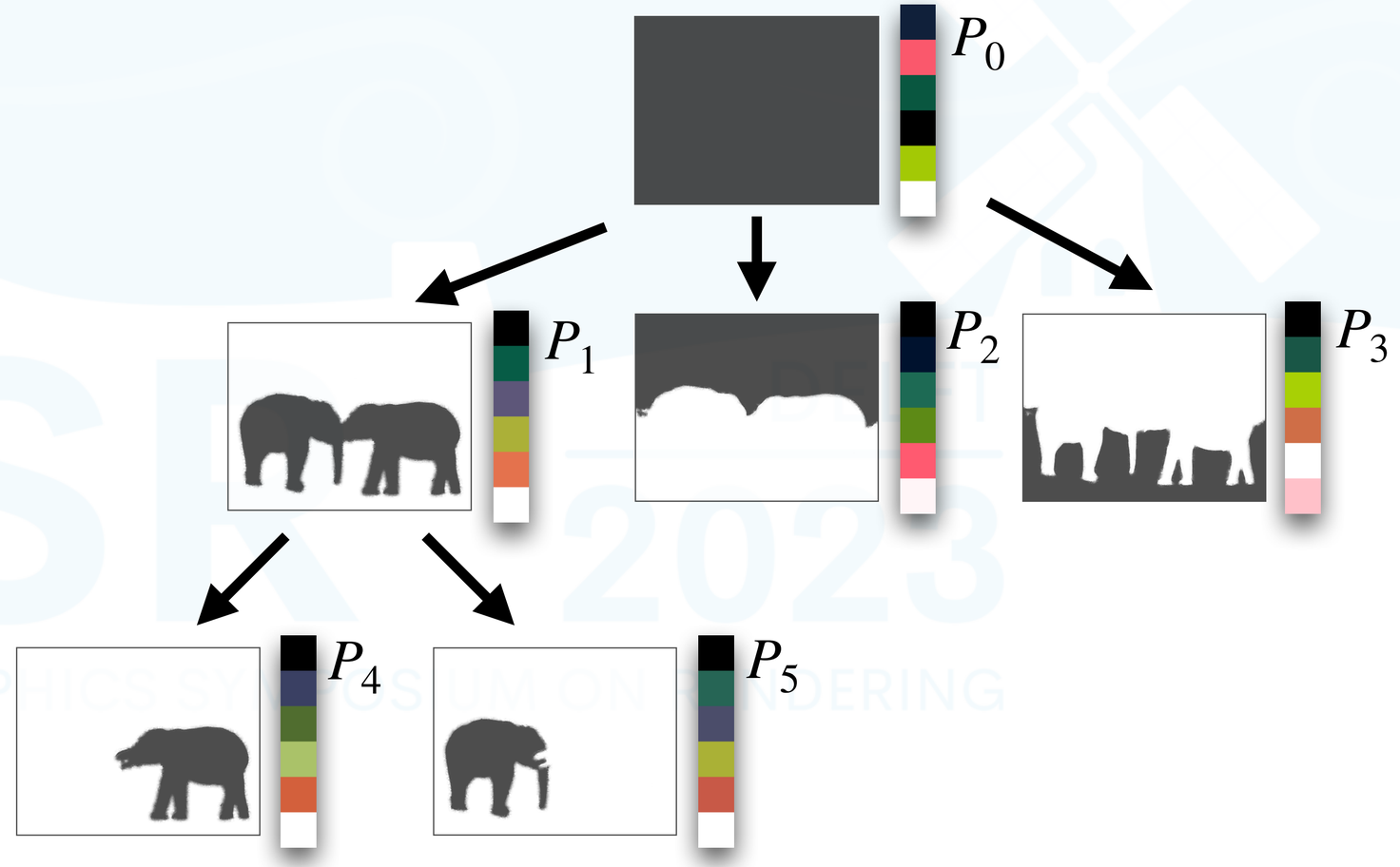
Image I

P_i , W_i



Sparse Editing *with* Hierarchy

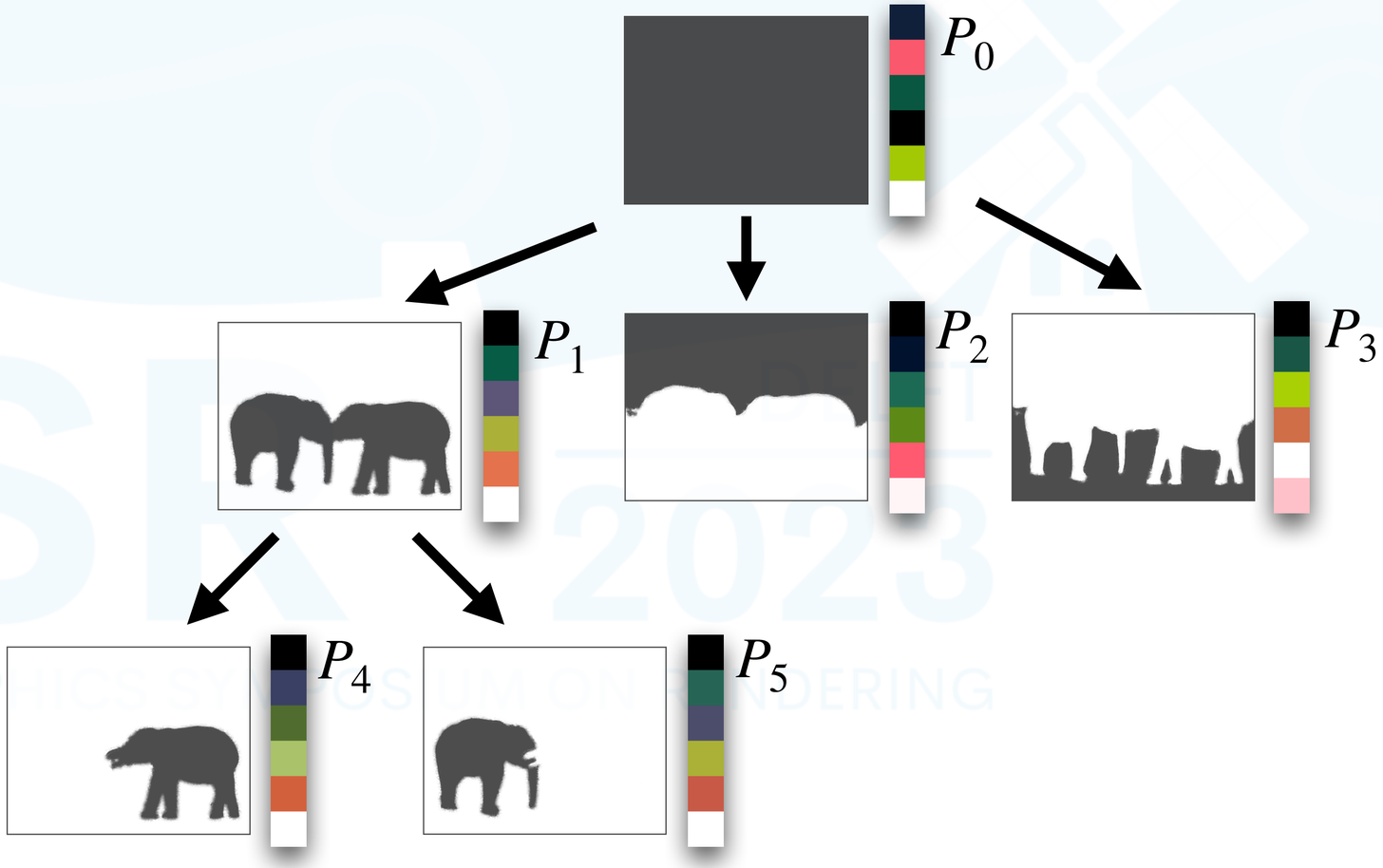
Palette splitting rules



Sparse Editing *with* Hierarchy

Palette splitting rules

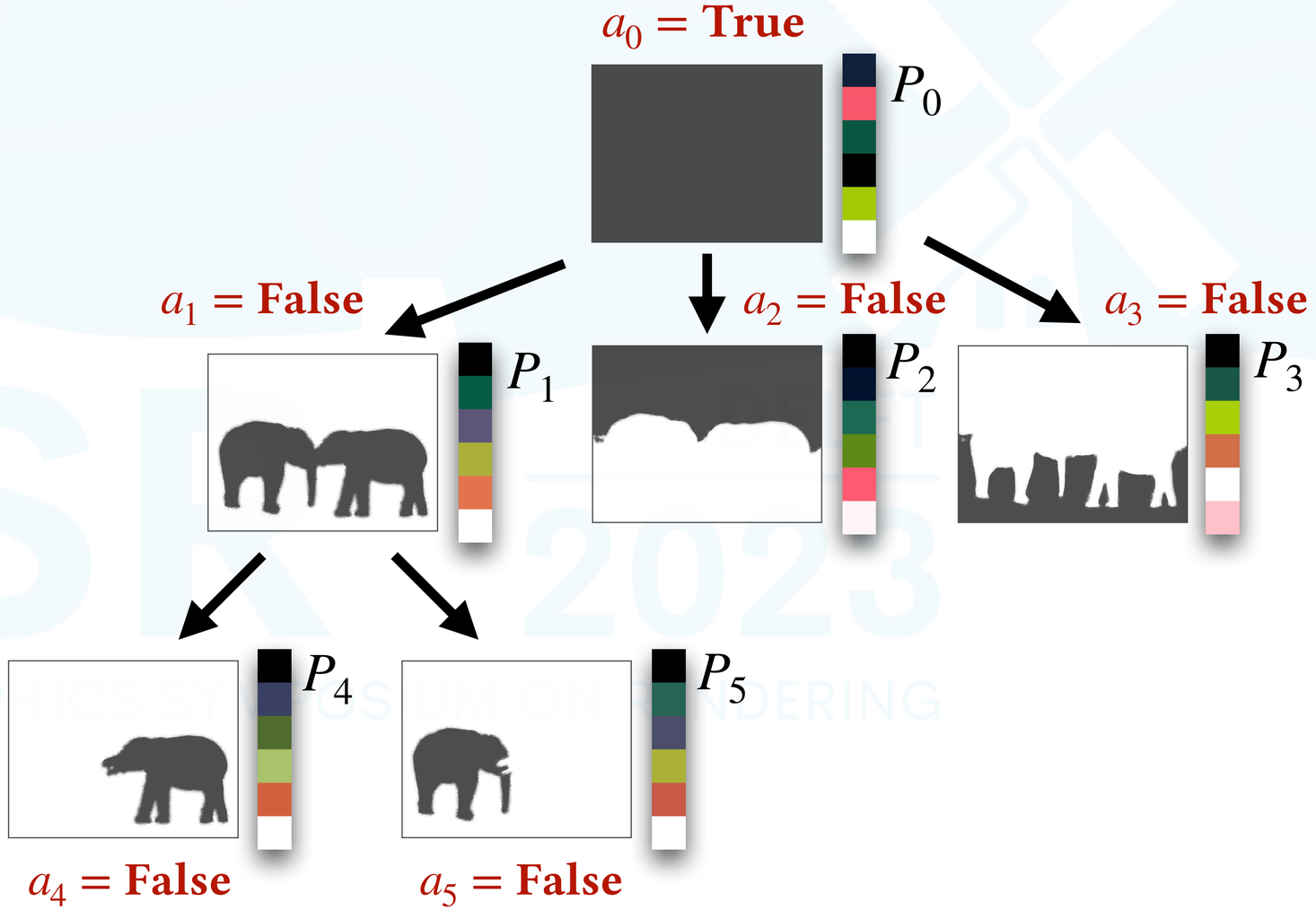
- Store booleans to track node activations



Sparse Editing *with* Hierarchy

Palette splitting rules

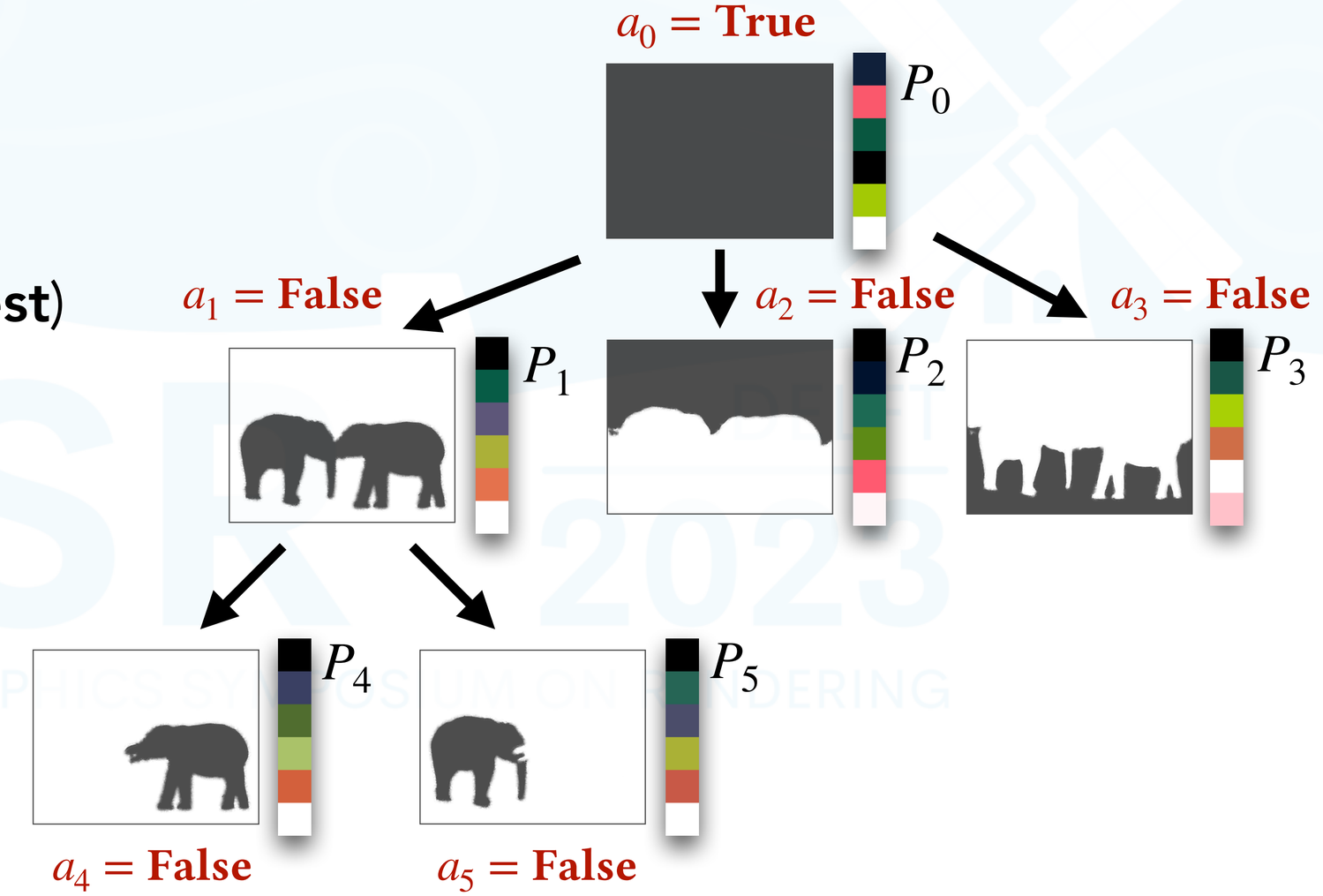
- Store booleans to track node activations



Sparse Editing *with* Hierarchy

Palette splitting rules

- Store booleans to track node activations
- A new image-space constraint starts at the most local (**deepest**) ***active*** node containing it



Sparse Editing *with* Hierarchy

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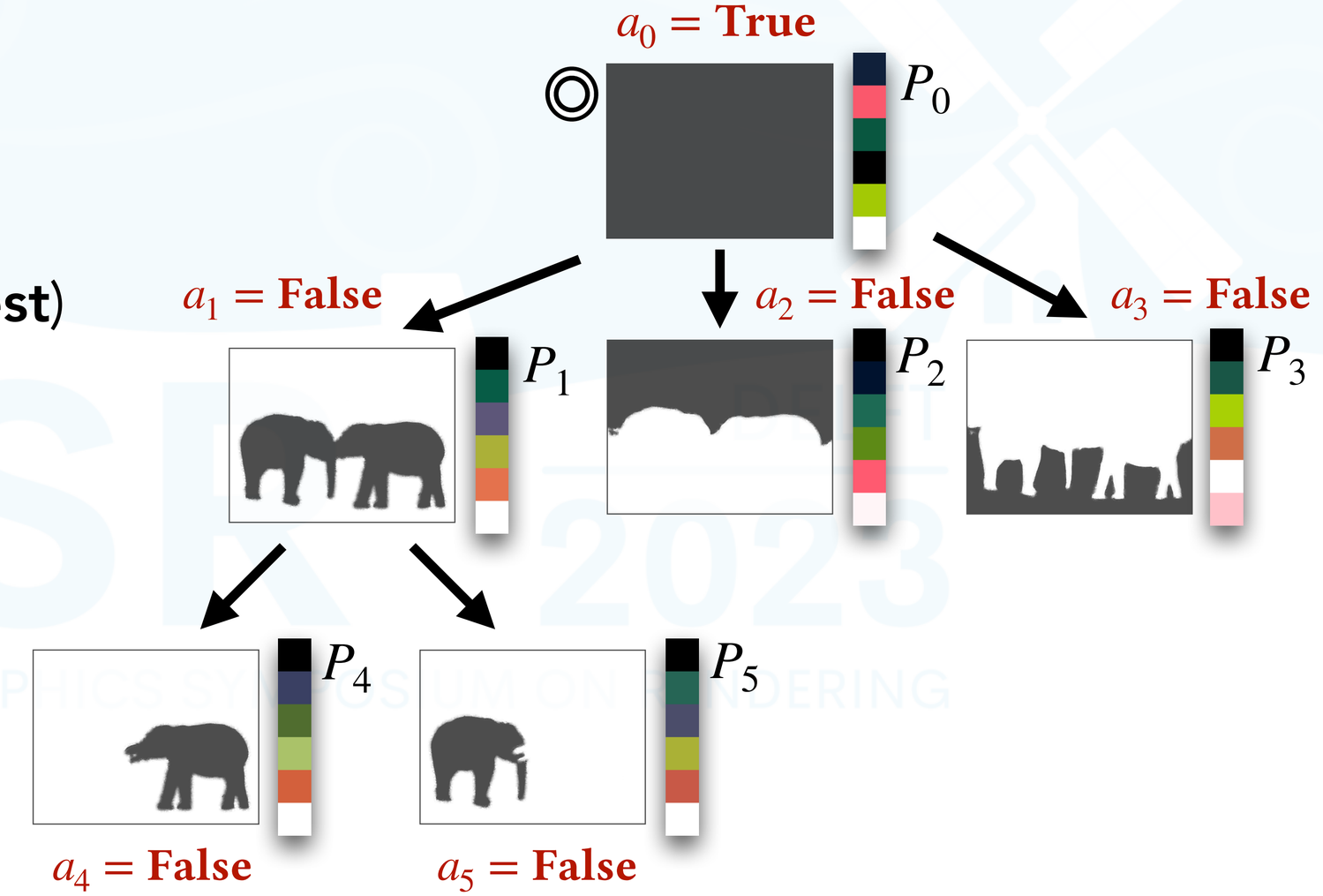

Sparse Editing *with* Hierarchy

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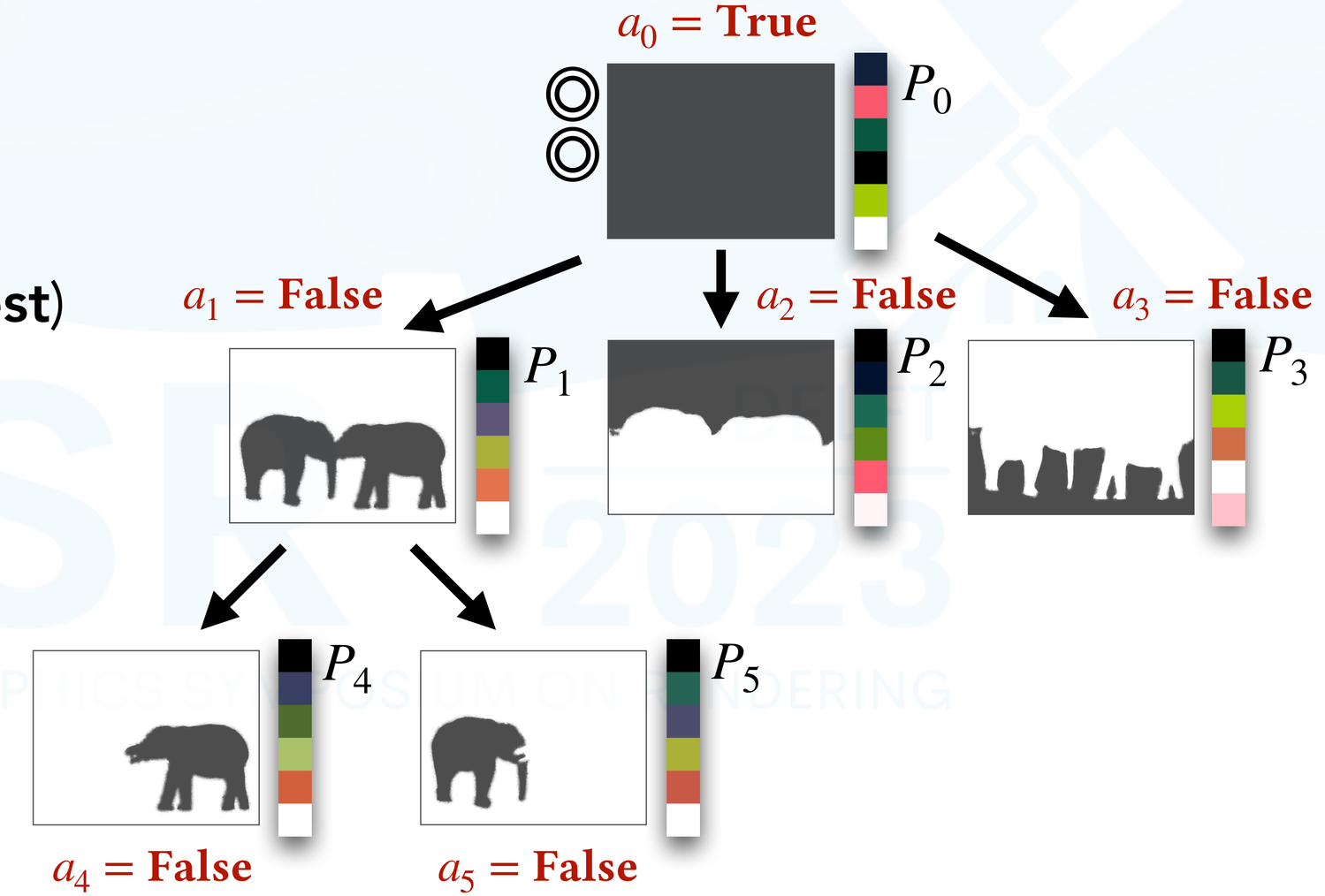

Sparse Editing *with* Hierarchy

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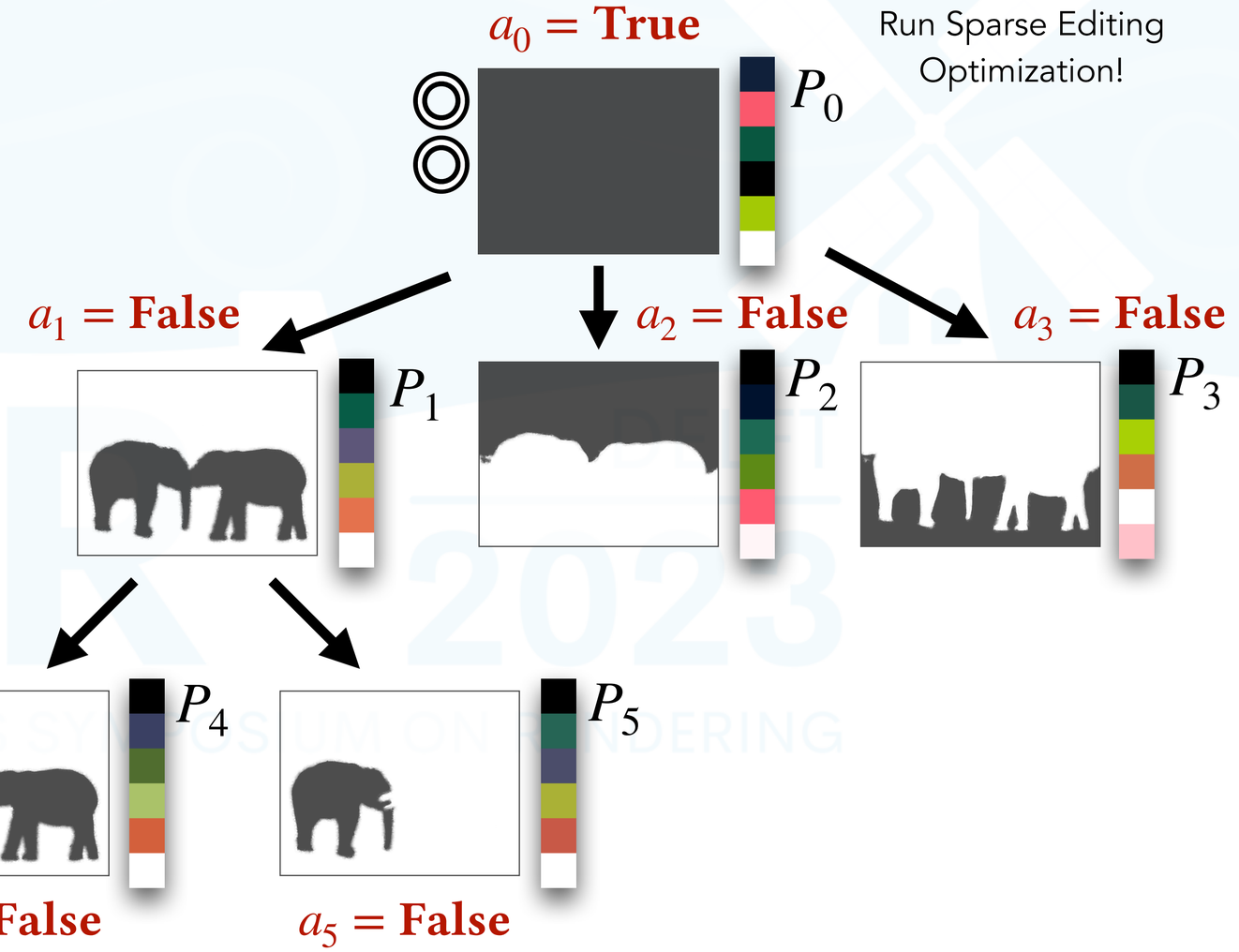

Sparse Editing *with* Hierarchy

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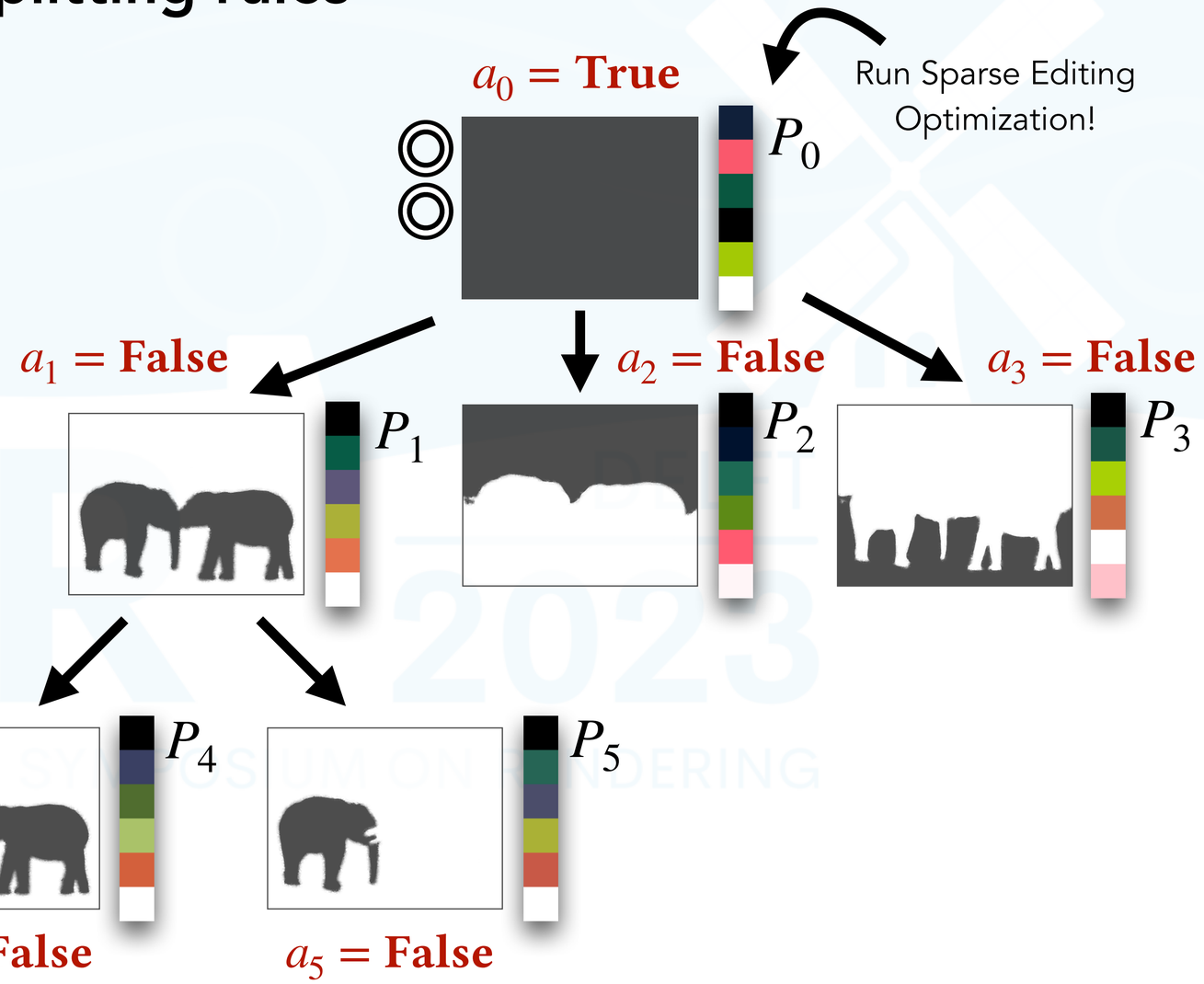
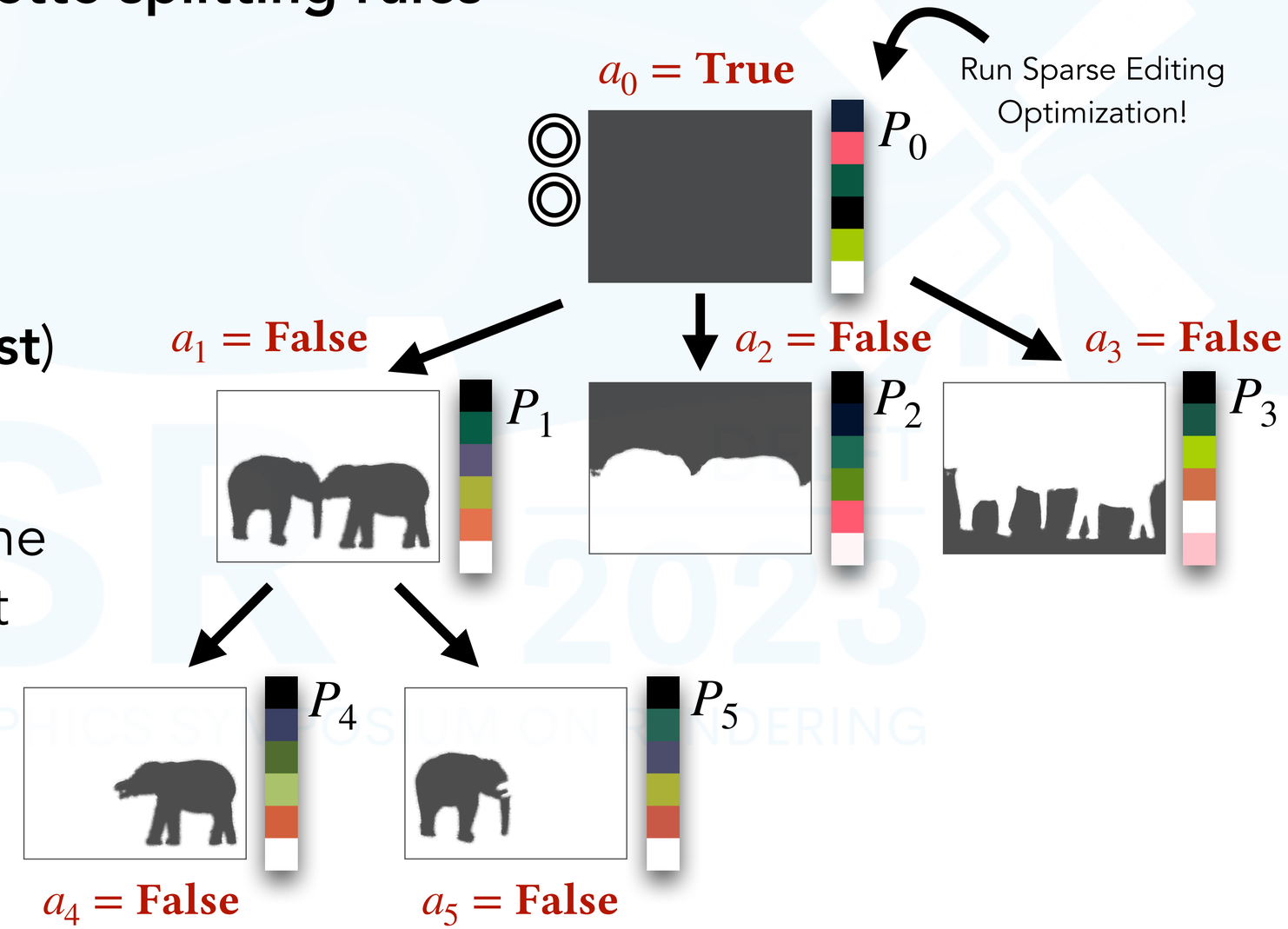
- A new image-space constraint starts at the most local (**deepest**) ***active*** node containing it



Sparse Editing *with* Hierarchy

Palette splitting rules

- Store booleans to track node activations
- A new image-space constraint starts at the most local (**deepest**) ***active*** node containing it
- Optimization fails → activate the next deeper node containing it



Sparse Editing *with* Hierarchy

Palette splitting rules

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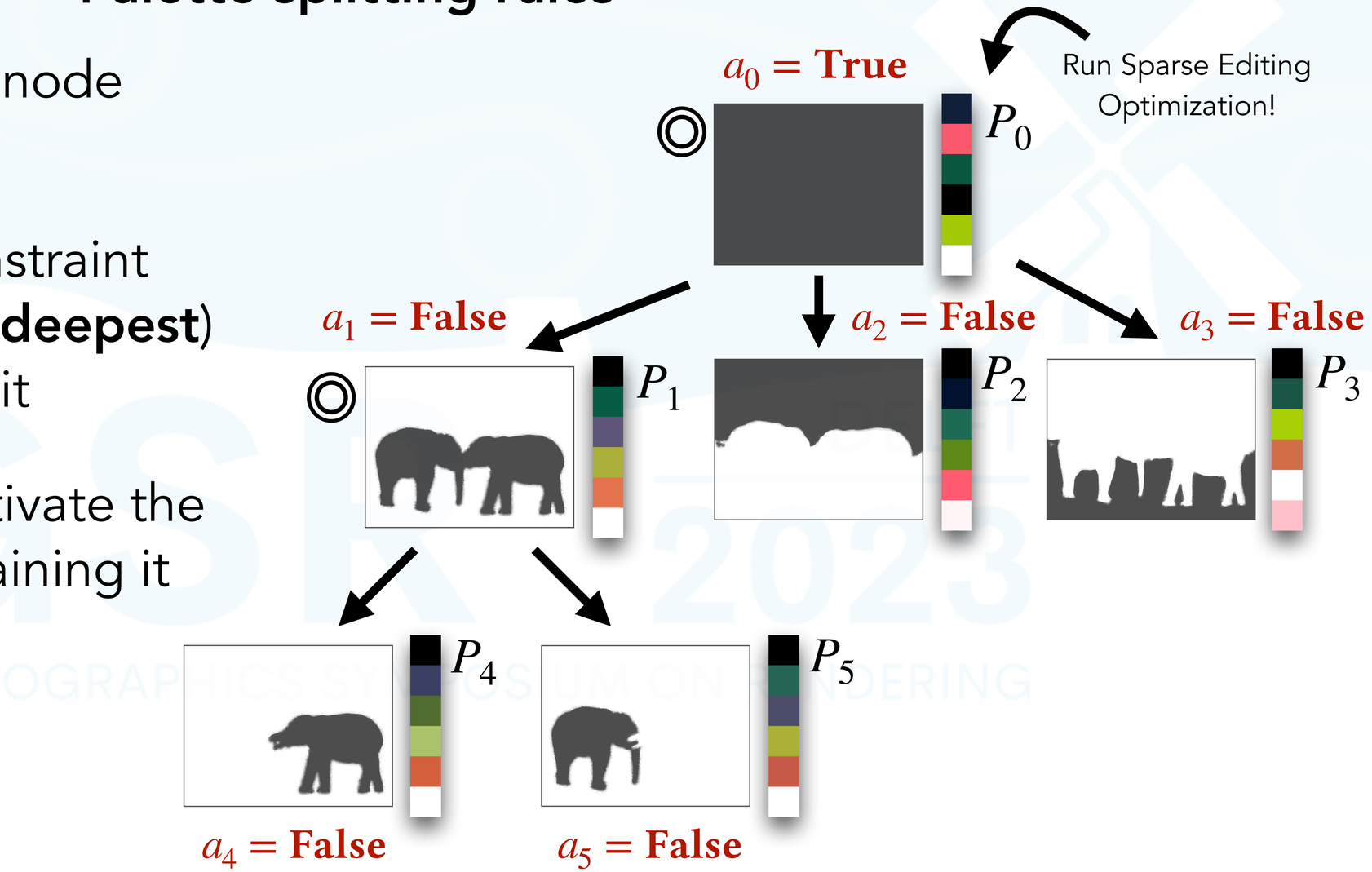

Sparse Editing *with* Hierarchy

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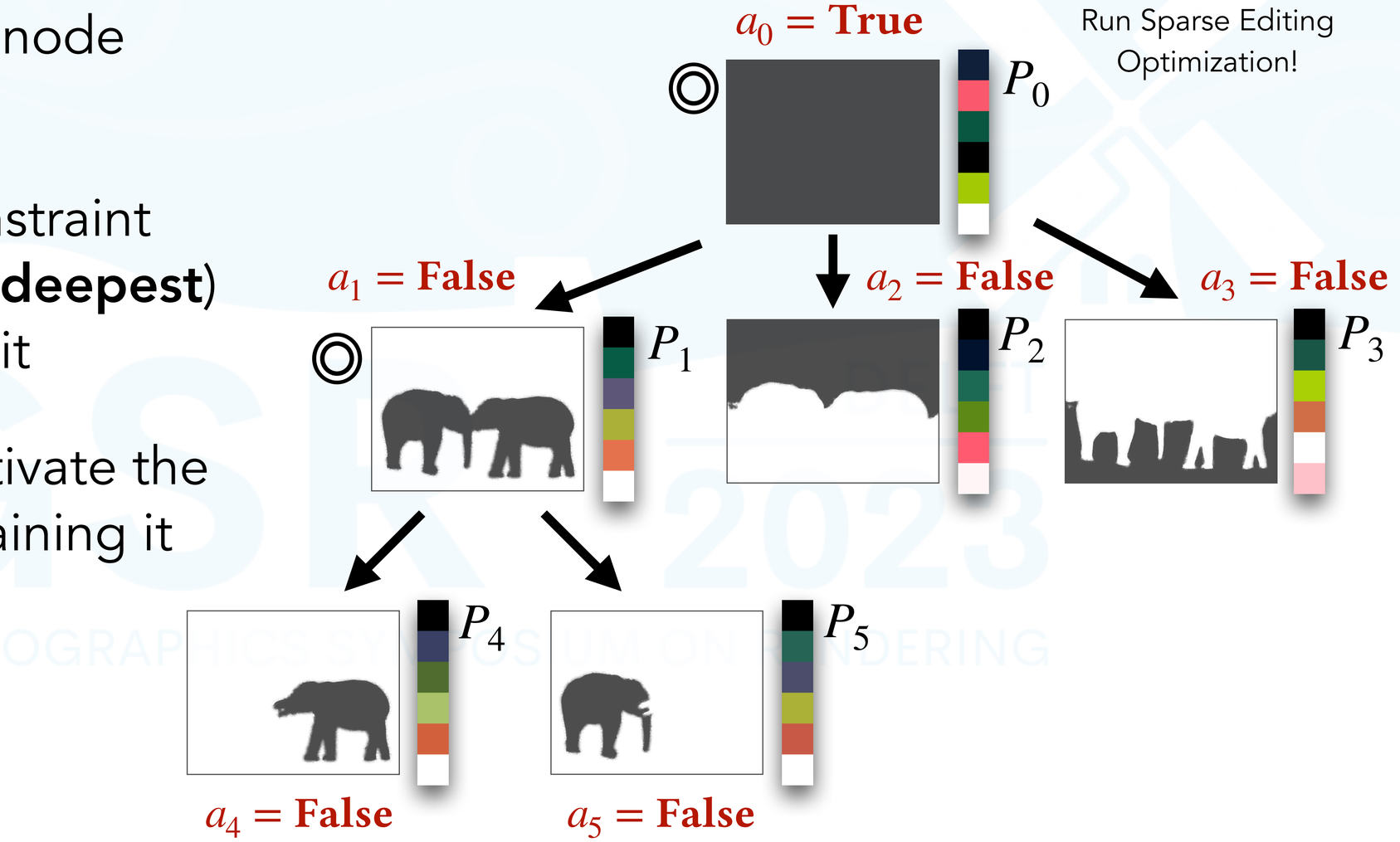

Sparse Editing *with* Hierarchy

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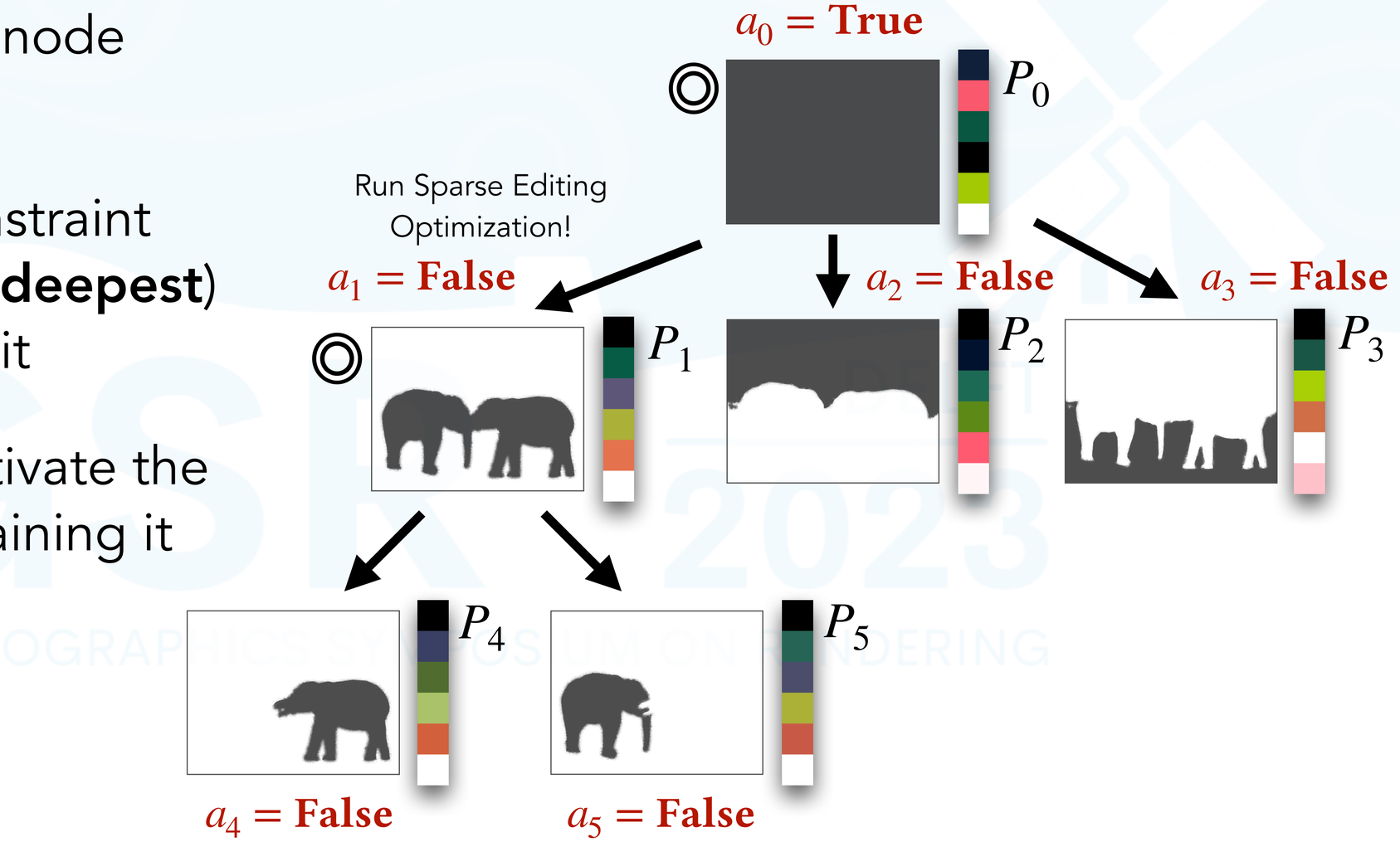

Sparse Editing *with* Hierarchy

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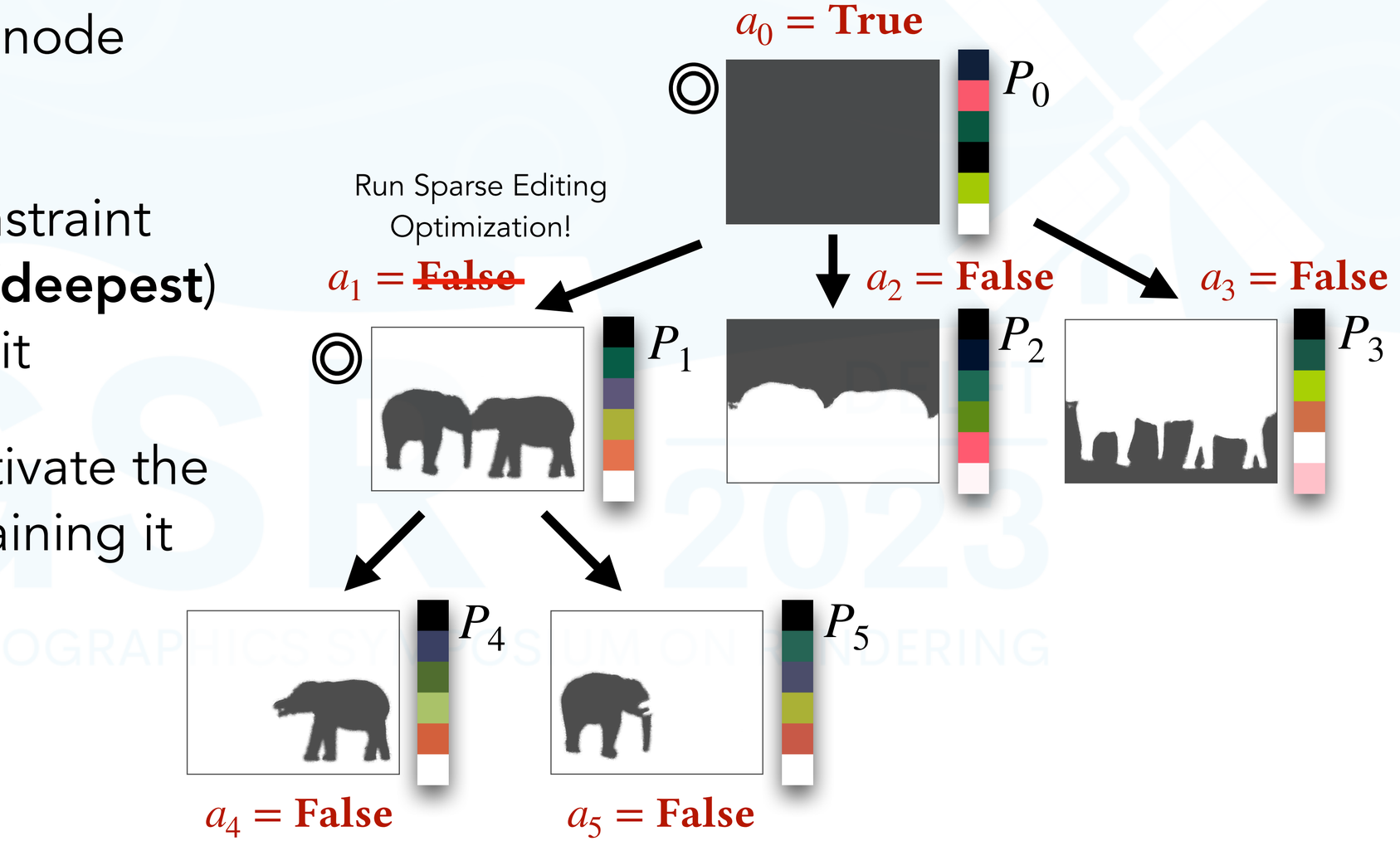

Sparse Editing *with* Hierarchy

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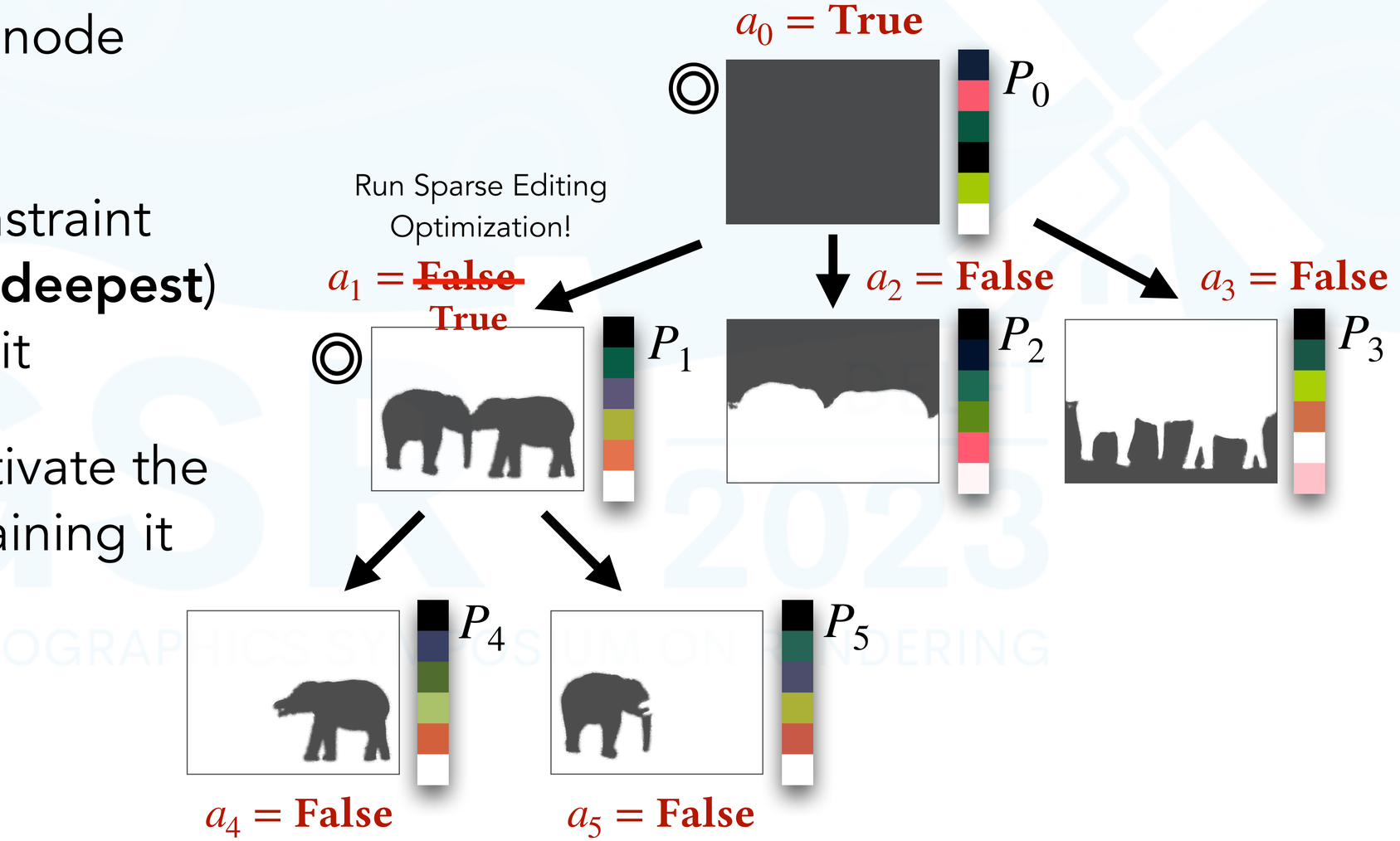

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Palette splitting rules

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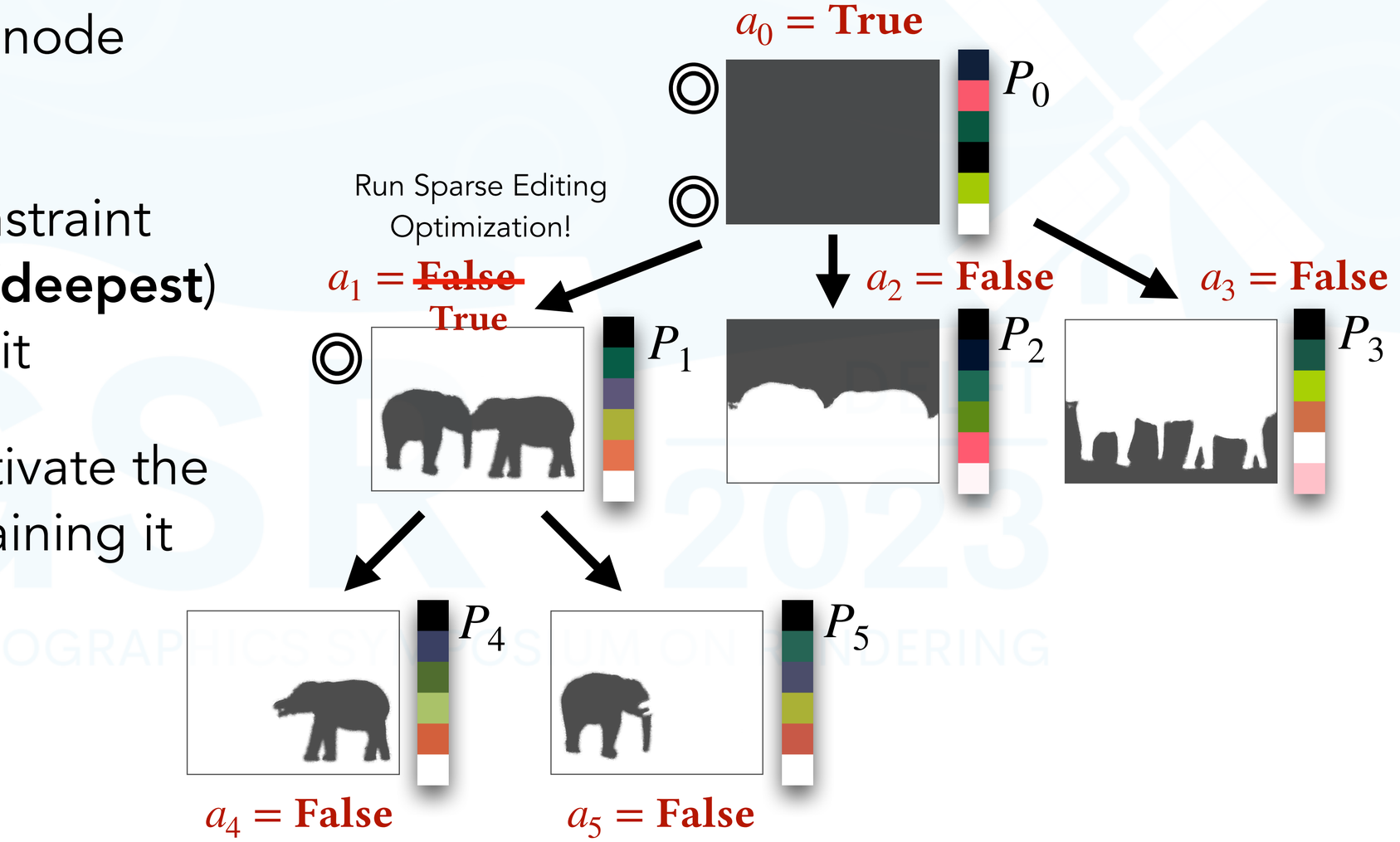

Sparse Editing *with* Hierarchy

Palette splitting rules

- Store booleans to track node activations
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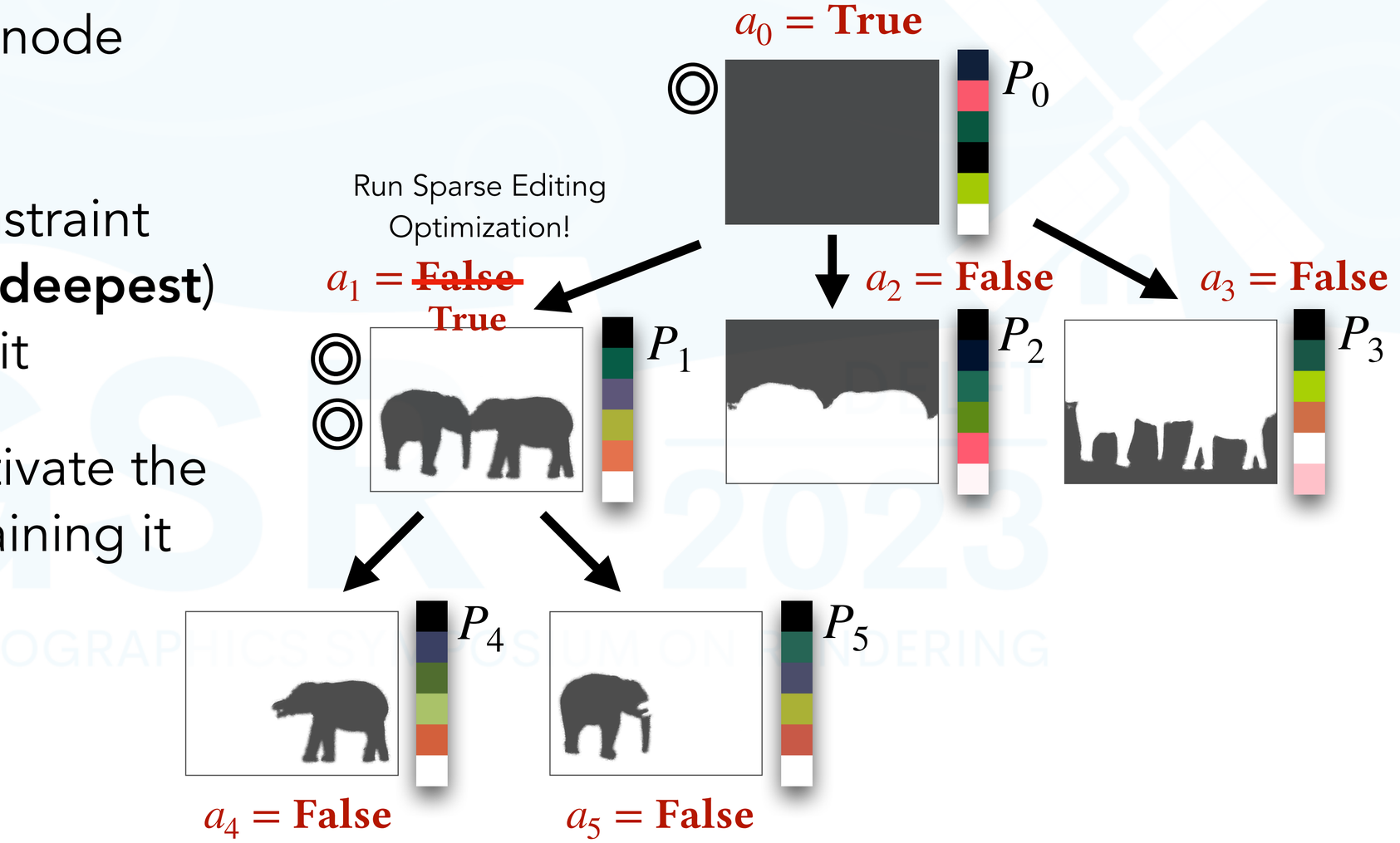
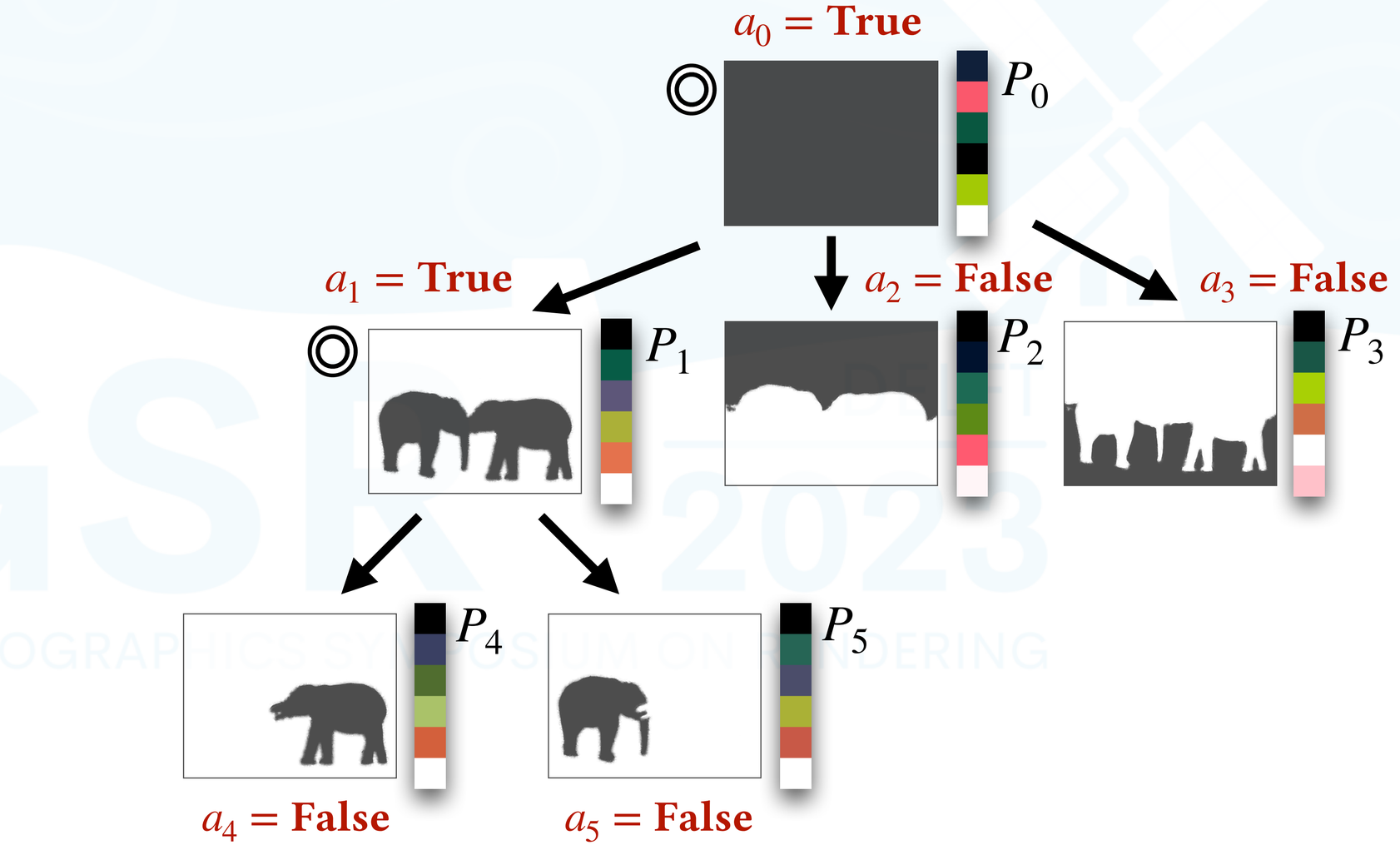


Palette and Weight Hierarchy

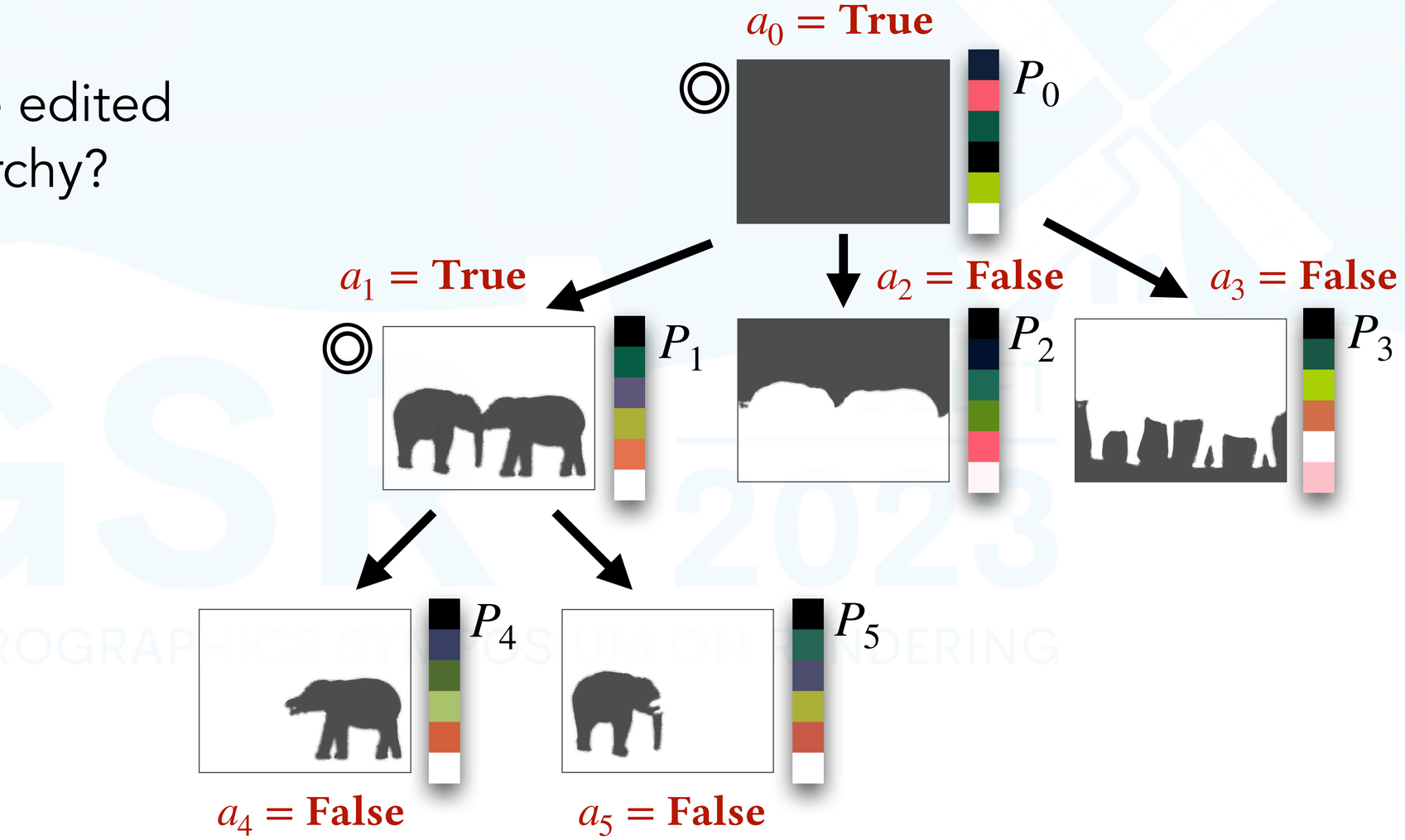
Reconstruction



Palette and Weight Hierarchy

Reconstruction

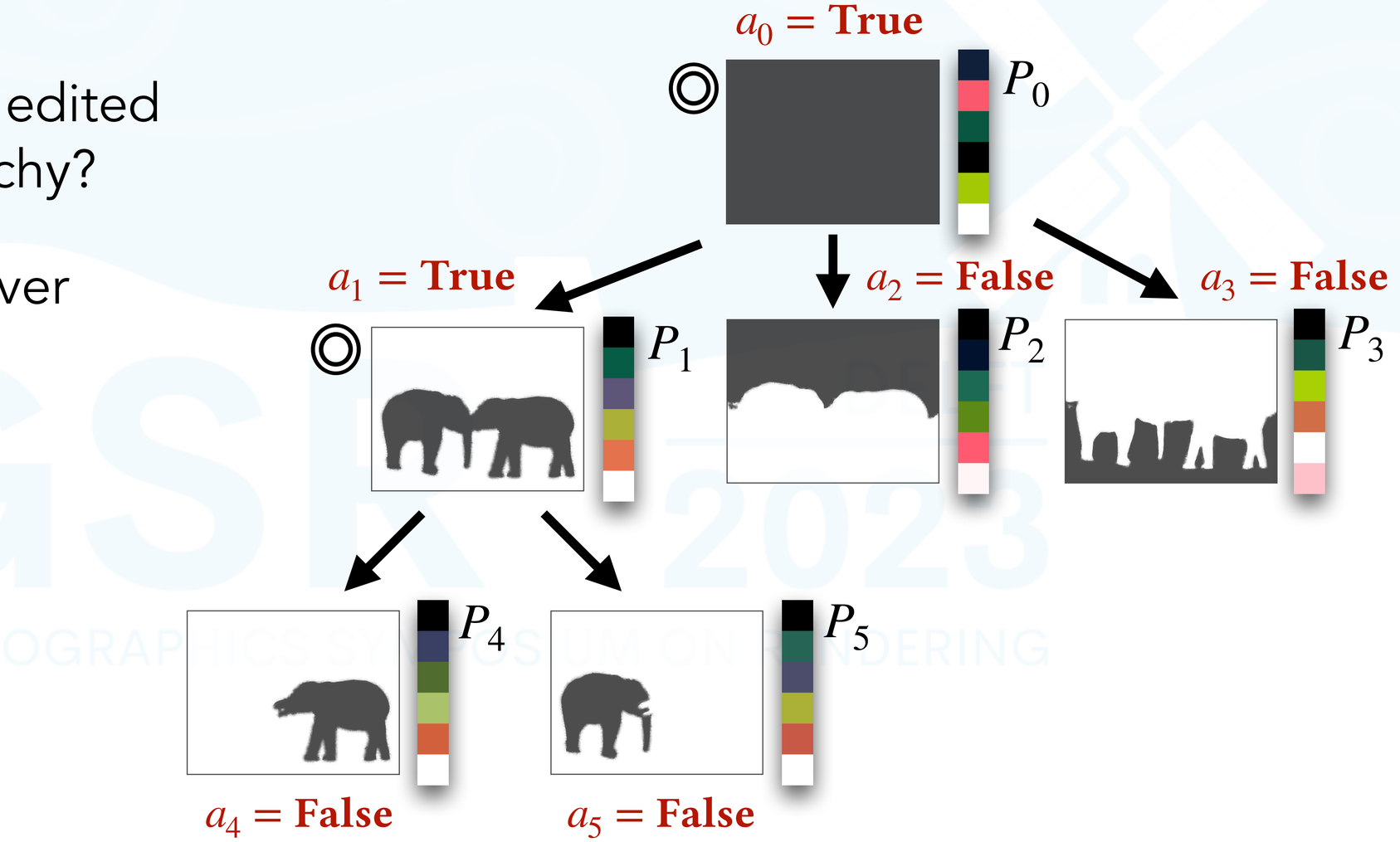
- How to reconstruct the edited image under the hierarchy?



Palette and Weight Hierarchy

Reconstruction

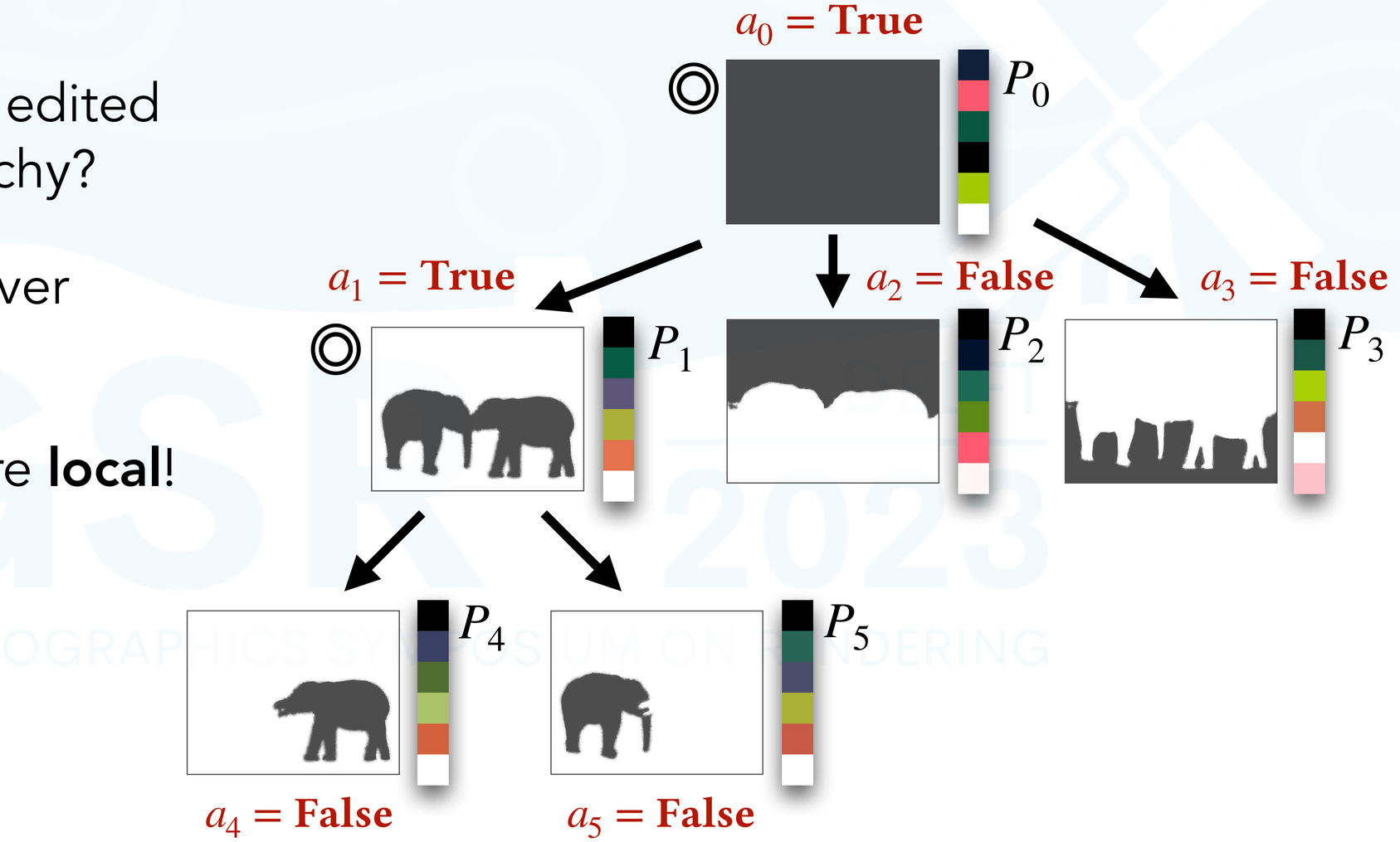
- How to reconstruct the edited image under the hierarchy?
  - Alpha compositing over activated nodes



Palette and Weight Hierarchy

Reconstruction

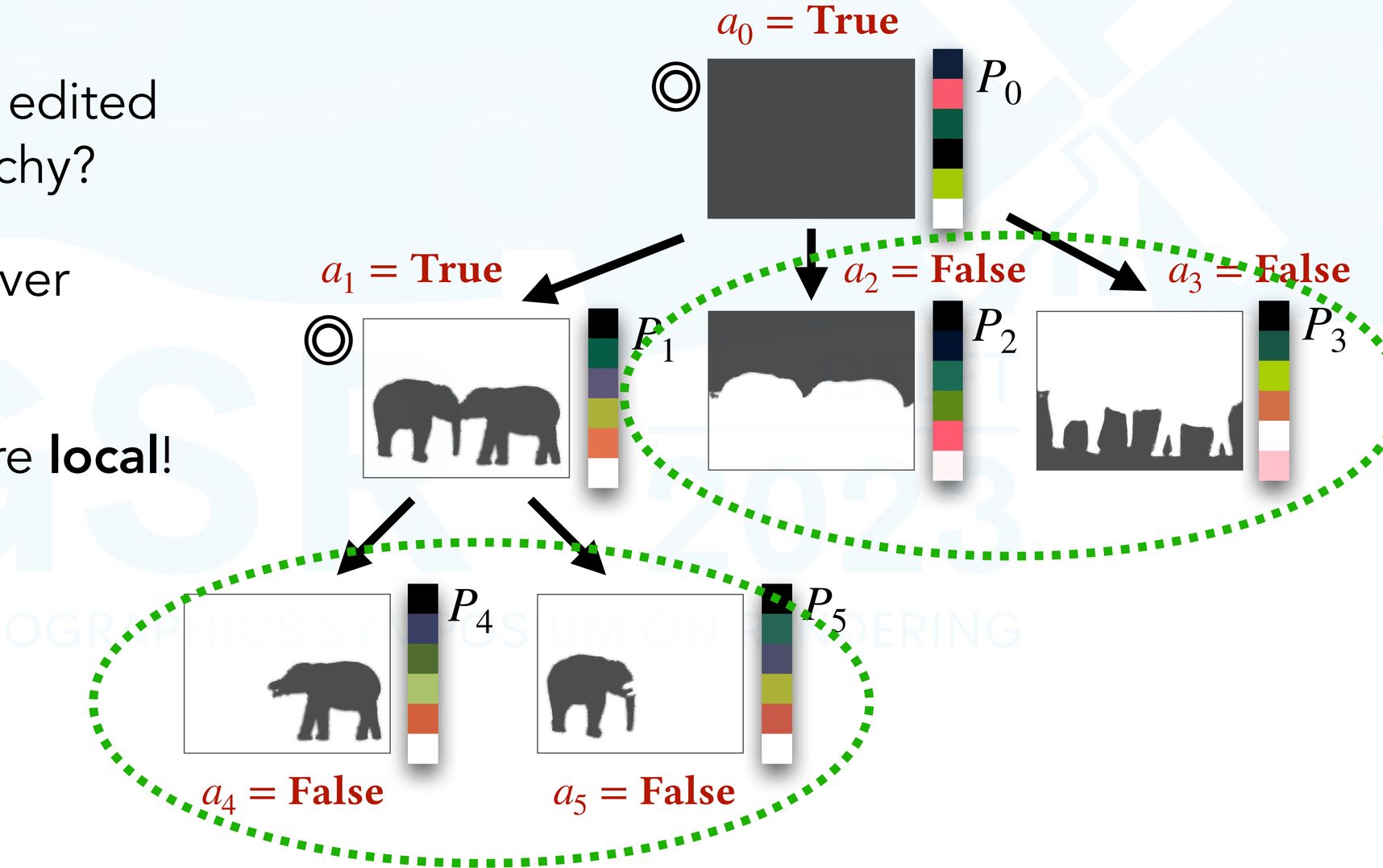
- How to reconstruct the edited image under the hierarchy?
  - Alpha compositing over activated nodes
  - Leaf palettes are more **local**!



Palette and Weight Hierarchy

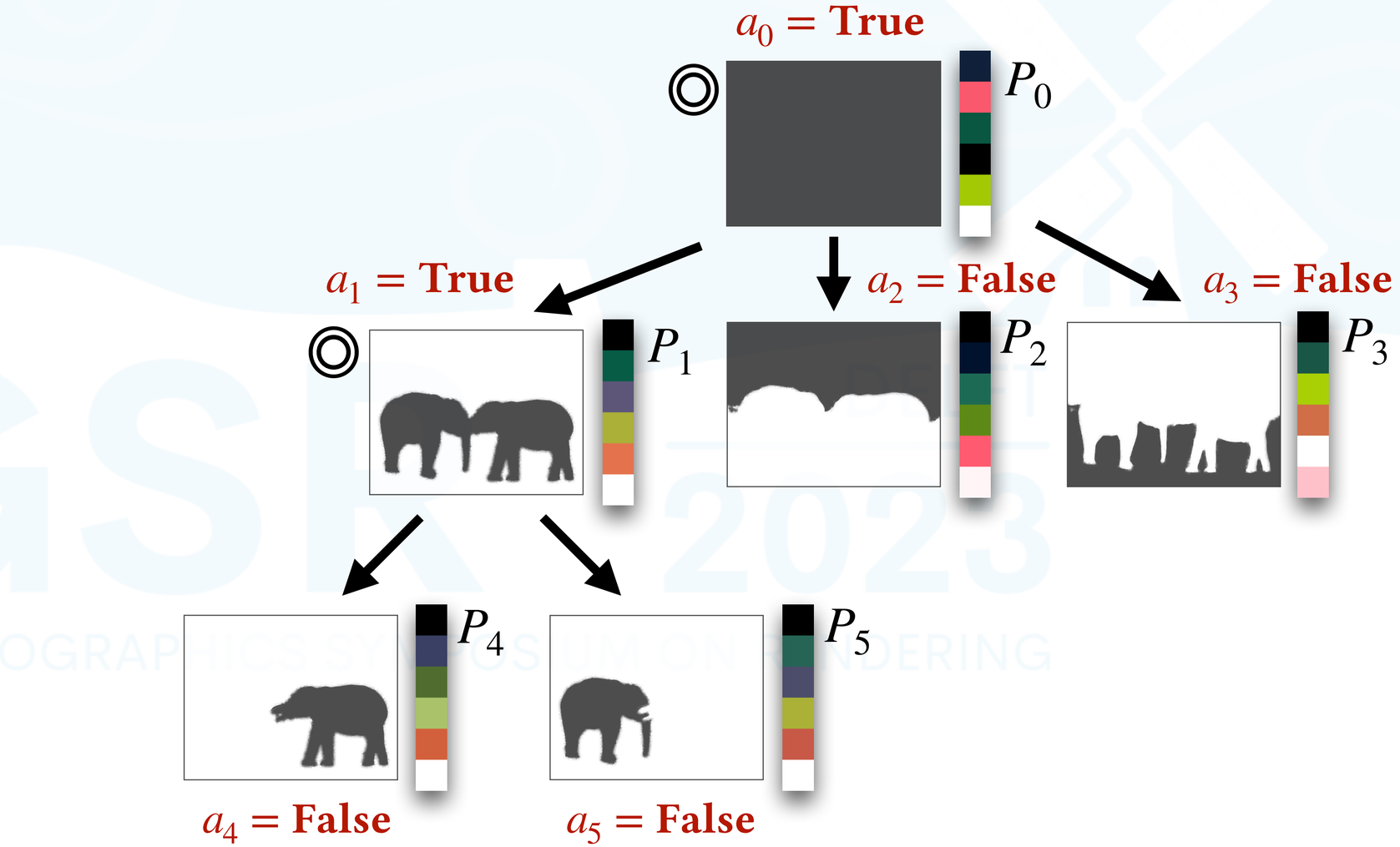
Reconstruction

- How to reconstruct the edited image under the hierarchy?
  - Alpha compositing over activated nodes
  - Leaf palettes are more **local**!



Palette and Weight Hierarchy

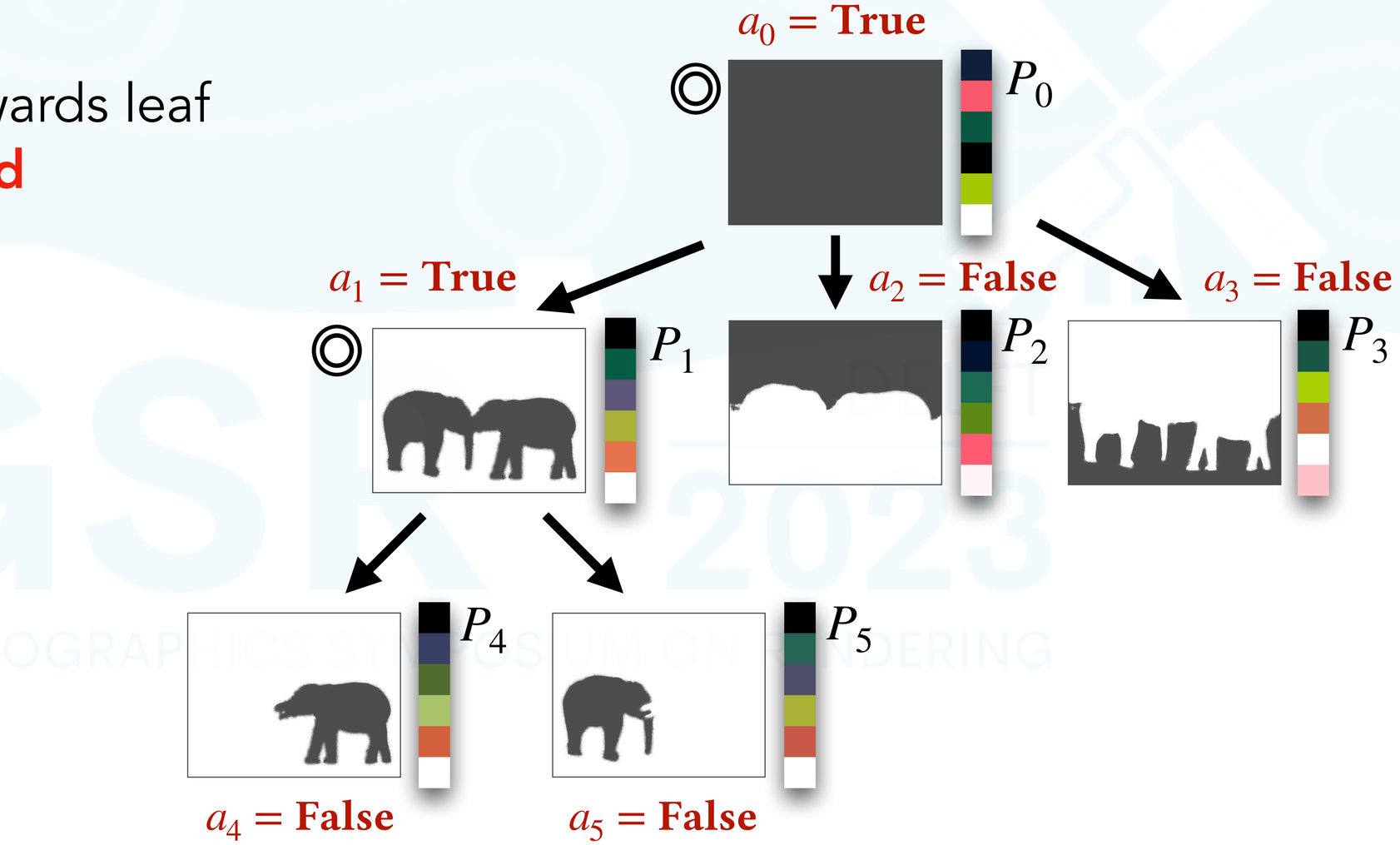
Palette Propagation



Palette and Weight Hierarchy

Palette Propagation

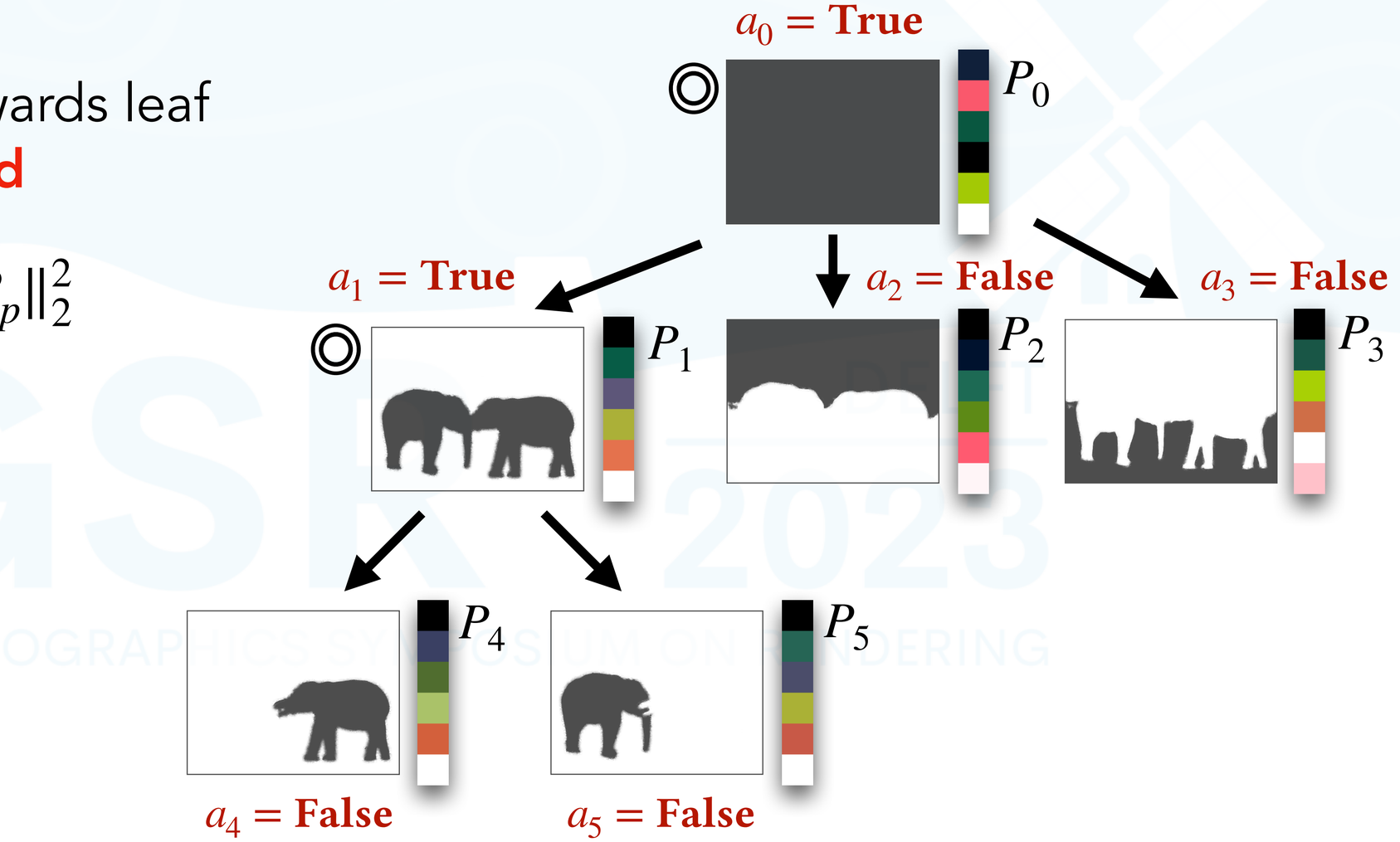
- Propagate changes towards leaf palettes if **not activated**



Palette and Weight Hierarchy

Palette Propagation

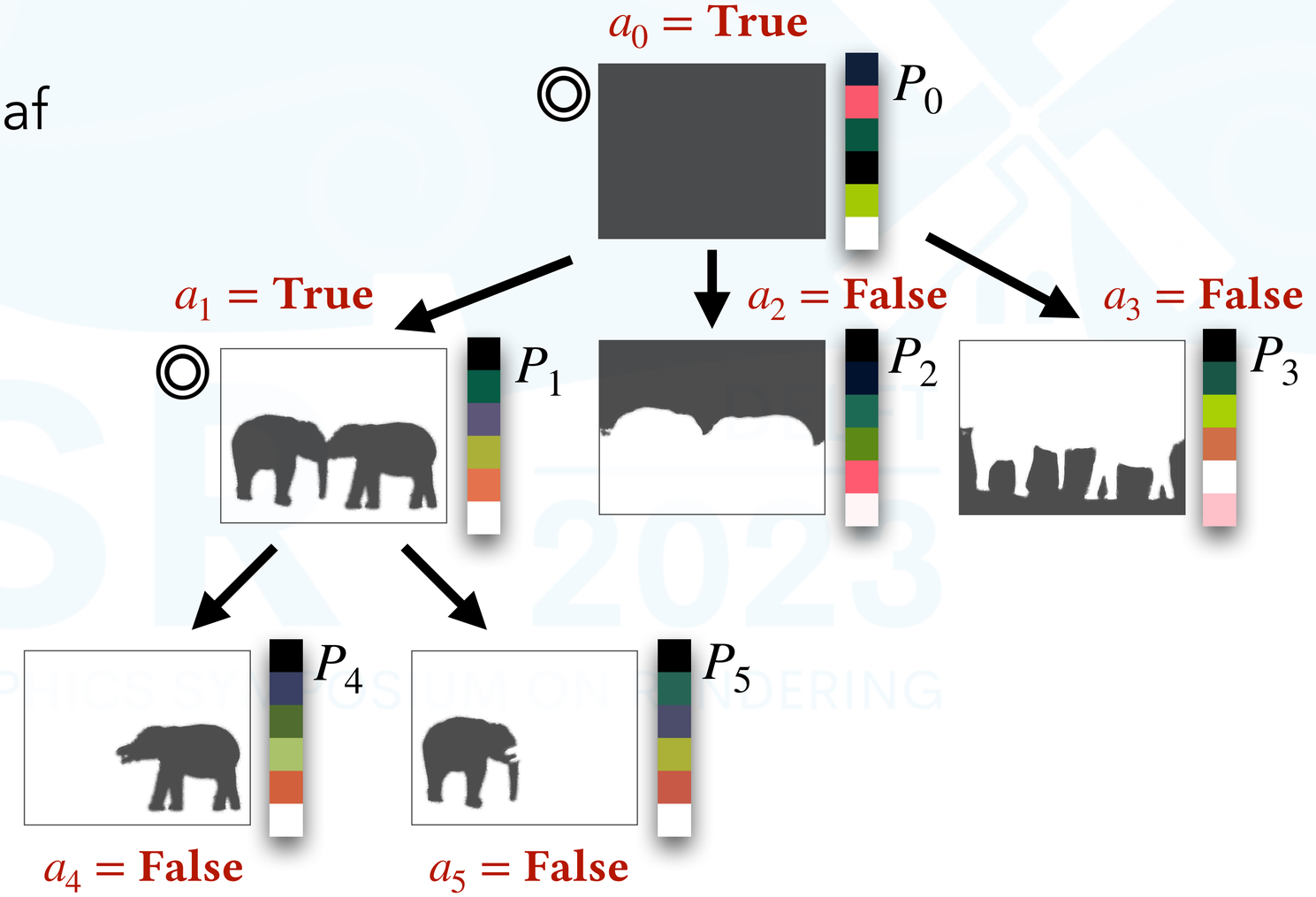
- Propagate changes towards leaf palettes if **not activated**
  - $\min_{P_c} \| W_c \cdot P_c - W_p \cdot P_p \|_2^2$



Palette and Weight Hierarchy

Palette Propagation

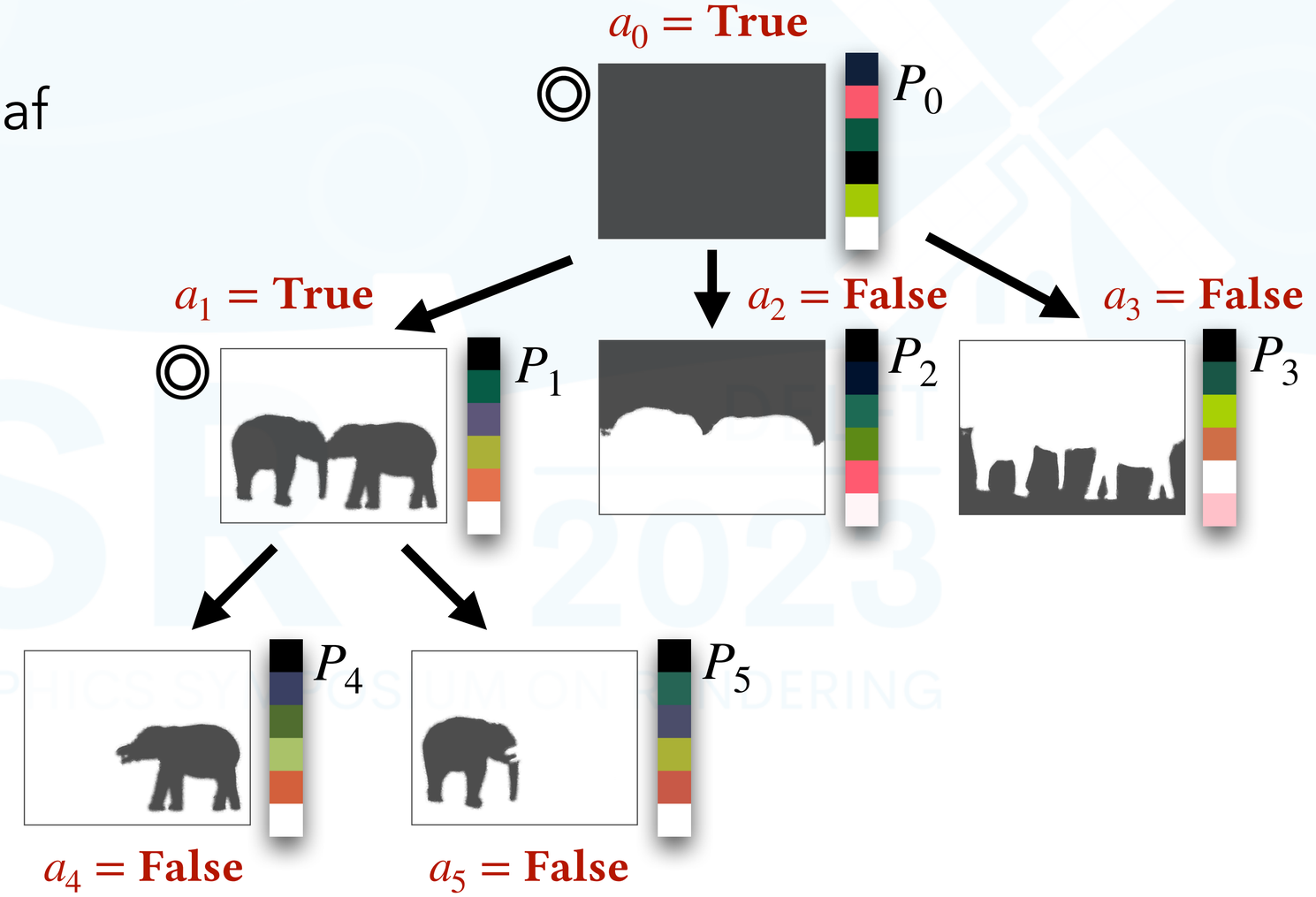
- Propagate changes towards leaf palettes if **not activated**
  - $\min_{P_c} \|W_c \cdot P_c - W_p \cdot P_p\|_2^2$
  - Subject to $0 \leq P_c \leq 1$



Palette and Weight Hierarchy

Palette Propagation

- Propagate changes towards leaf palettes if **not activated**
  - $\min_{P_c} \| W_c \cdot P_c - W_p \cdot P_p \|_2^2$
  - Subject to $0 \leq P_c \leq 1$

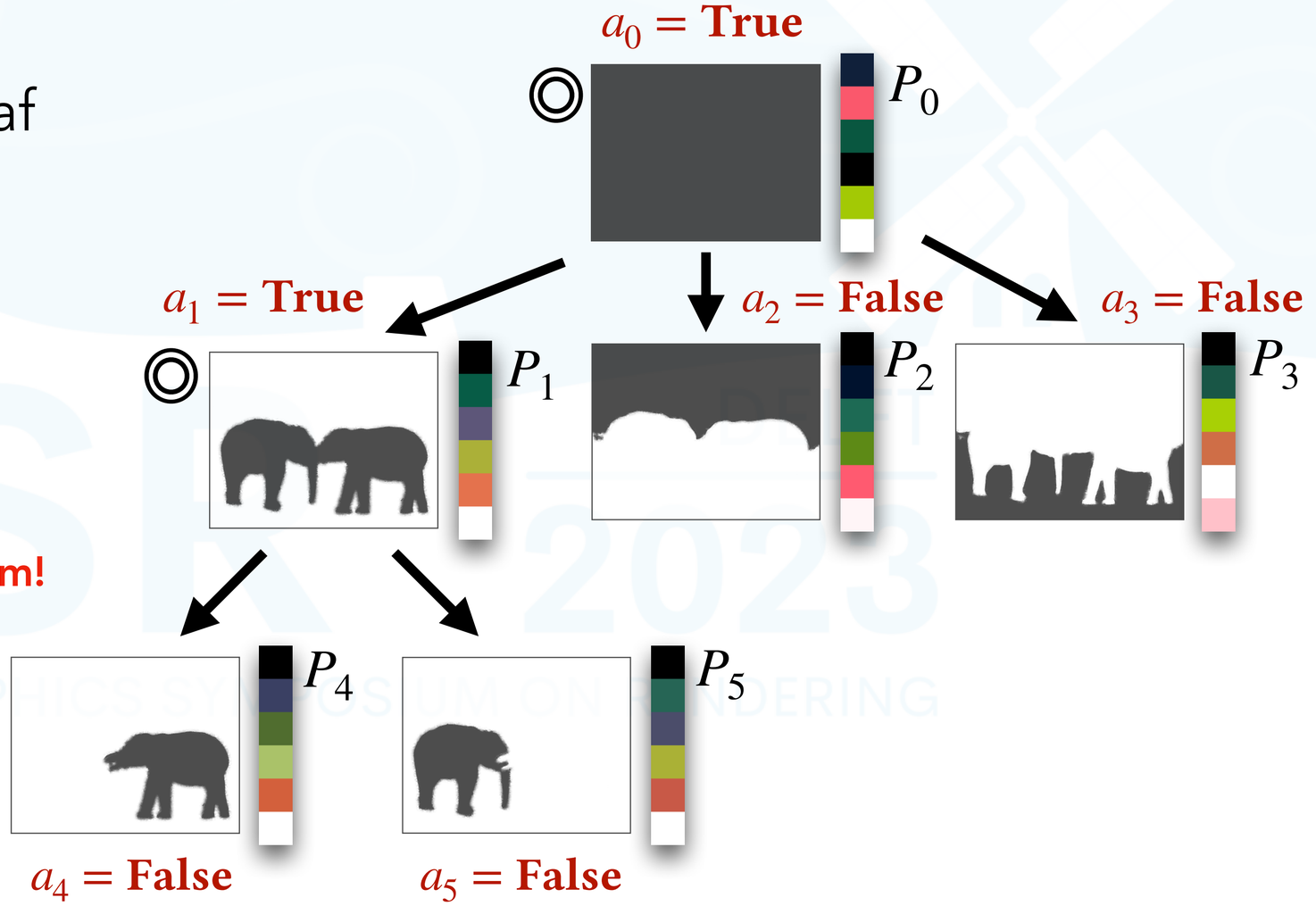


Palette and Weight Hierarchy

Palette Propagation

- Propagate changes towards leaf palettes if **not activated**
  - $\min_{P_c} \| W_c \cdot P_c - W_p \cdot P_p \|_2^2$
  - Subject to $0 \leq P_c \leq 1$

Small #p x #p quadratic programming problem!

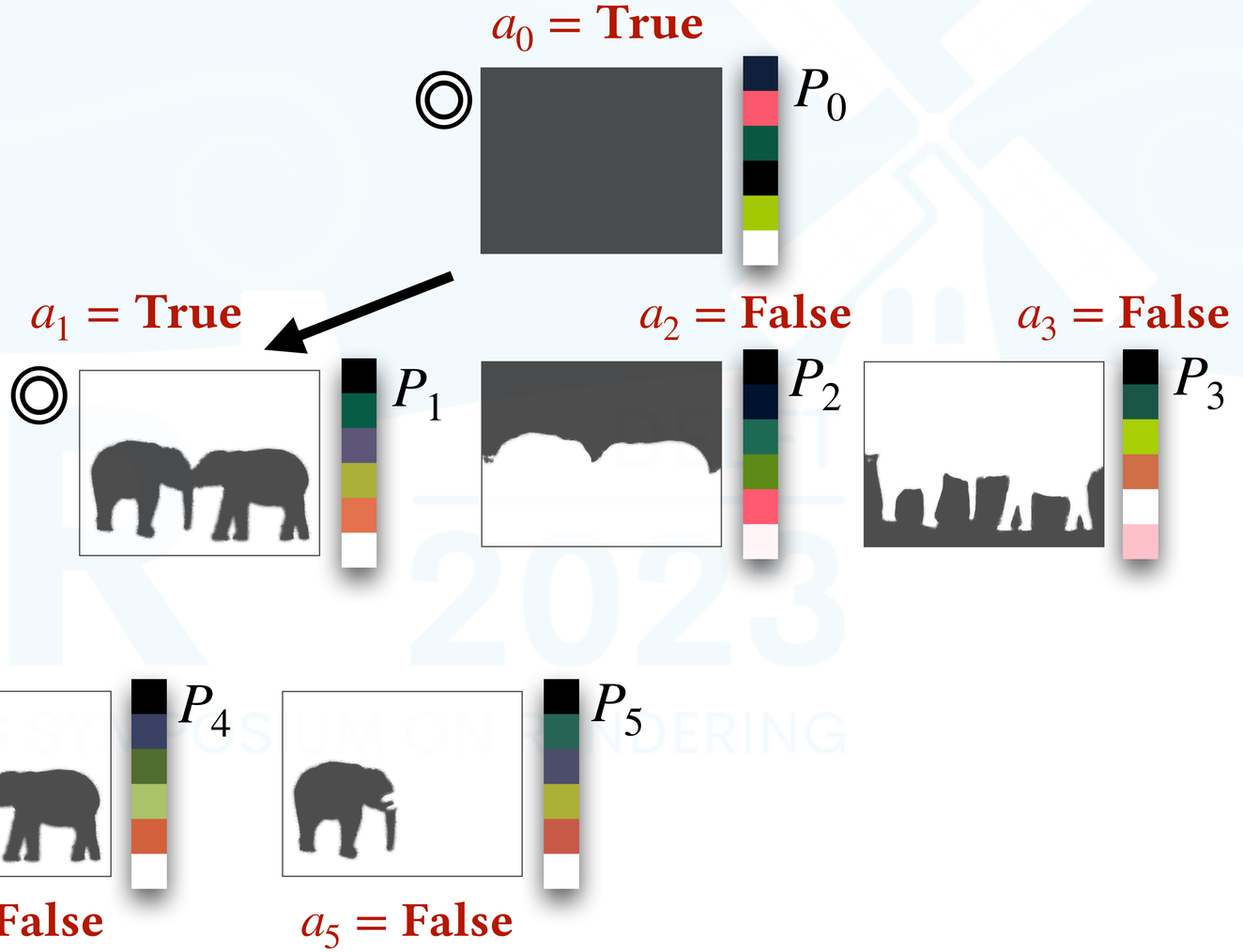


Palette and Weight Hierarchy

Palette Propagation

- Propagate changes towards leaf palettes if **not activated**
  - $\min_{P_c} \| W_c \cdot P_c - W_p \cdot P_p \|_2^2$
  - Subject to $0 \leq P_c \leq 1$

Small #p x #p quadratic programming problem!

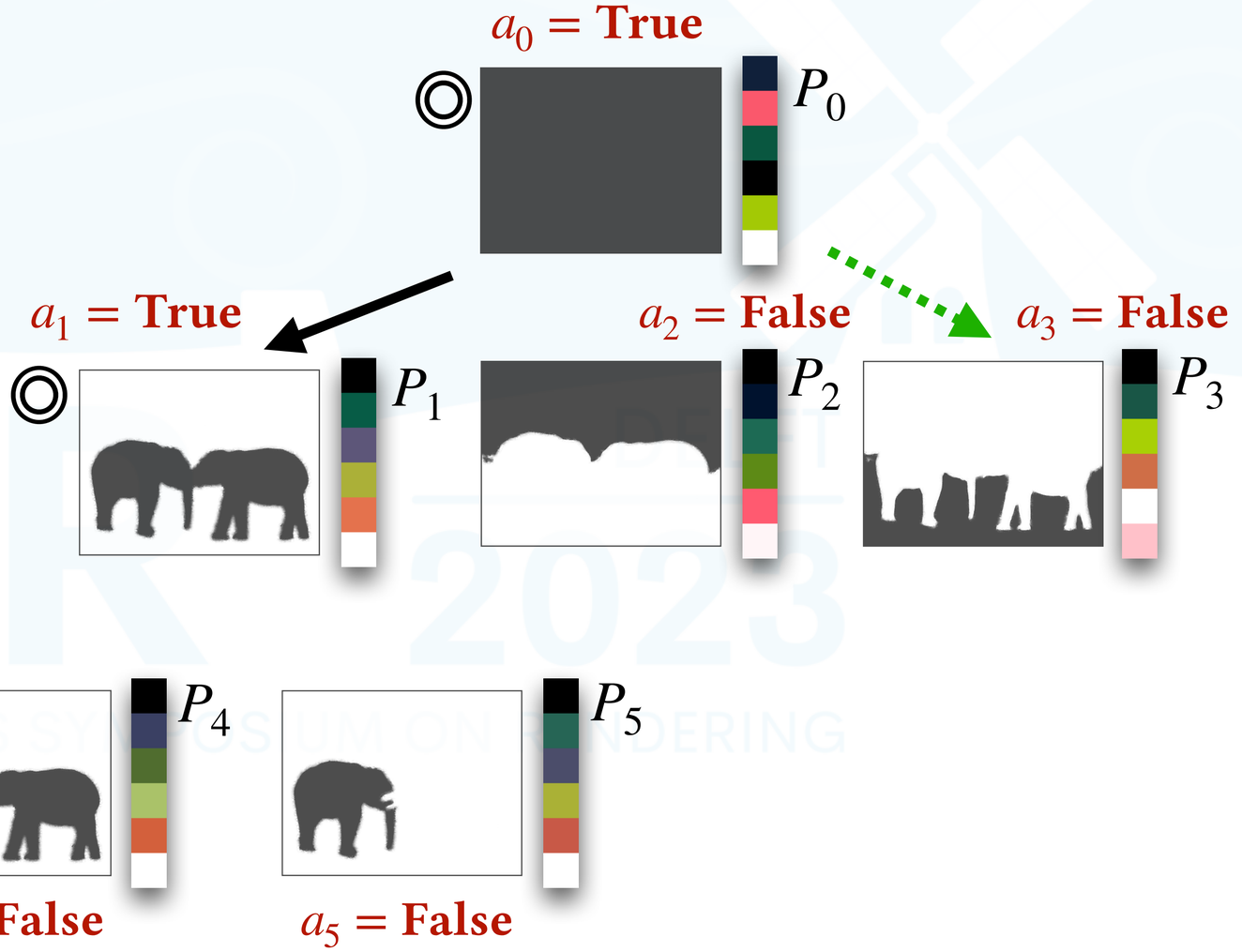


Palette and Weight Hierarchy

Palette Propagation

- Propagate changes towards leaf palettes if **not activated**
  - $\min_{P_c} \| W_c \cdot P_c - W_p \cdot P_p \|_2^2$
  - Subject to $0 \leq P_c \leq 1$

Small #p x #p quadratic programming problem!



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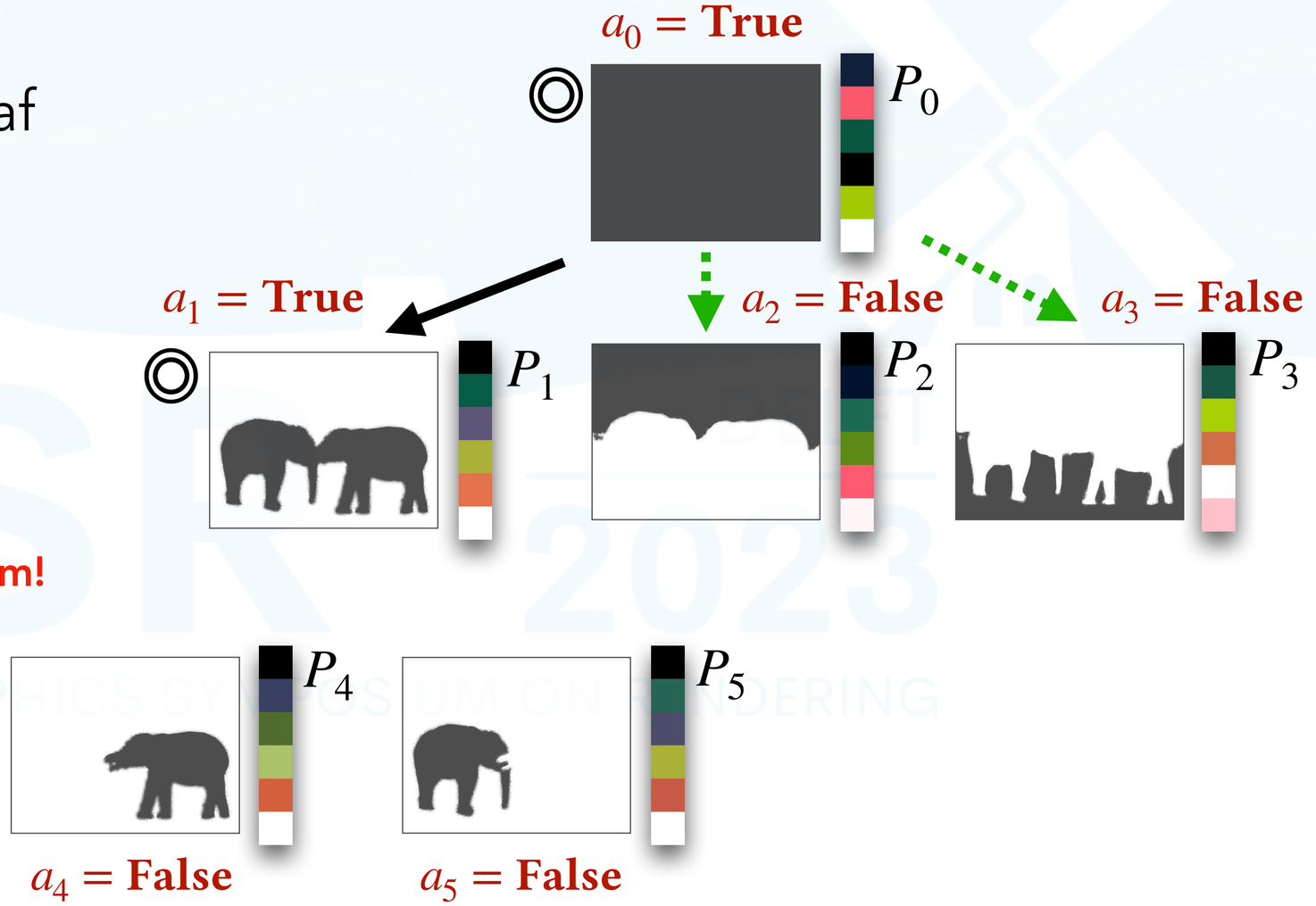

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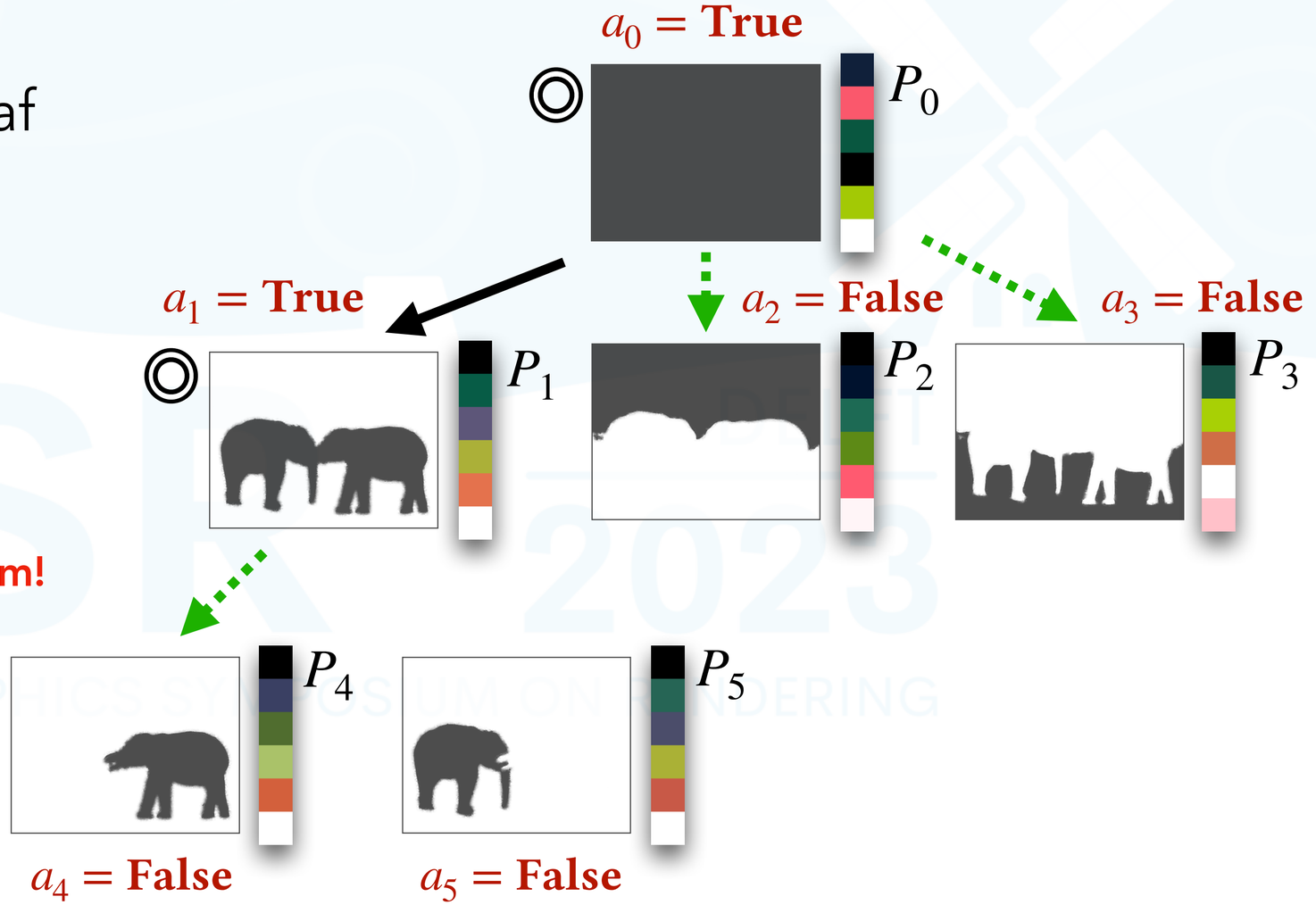

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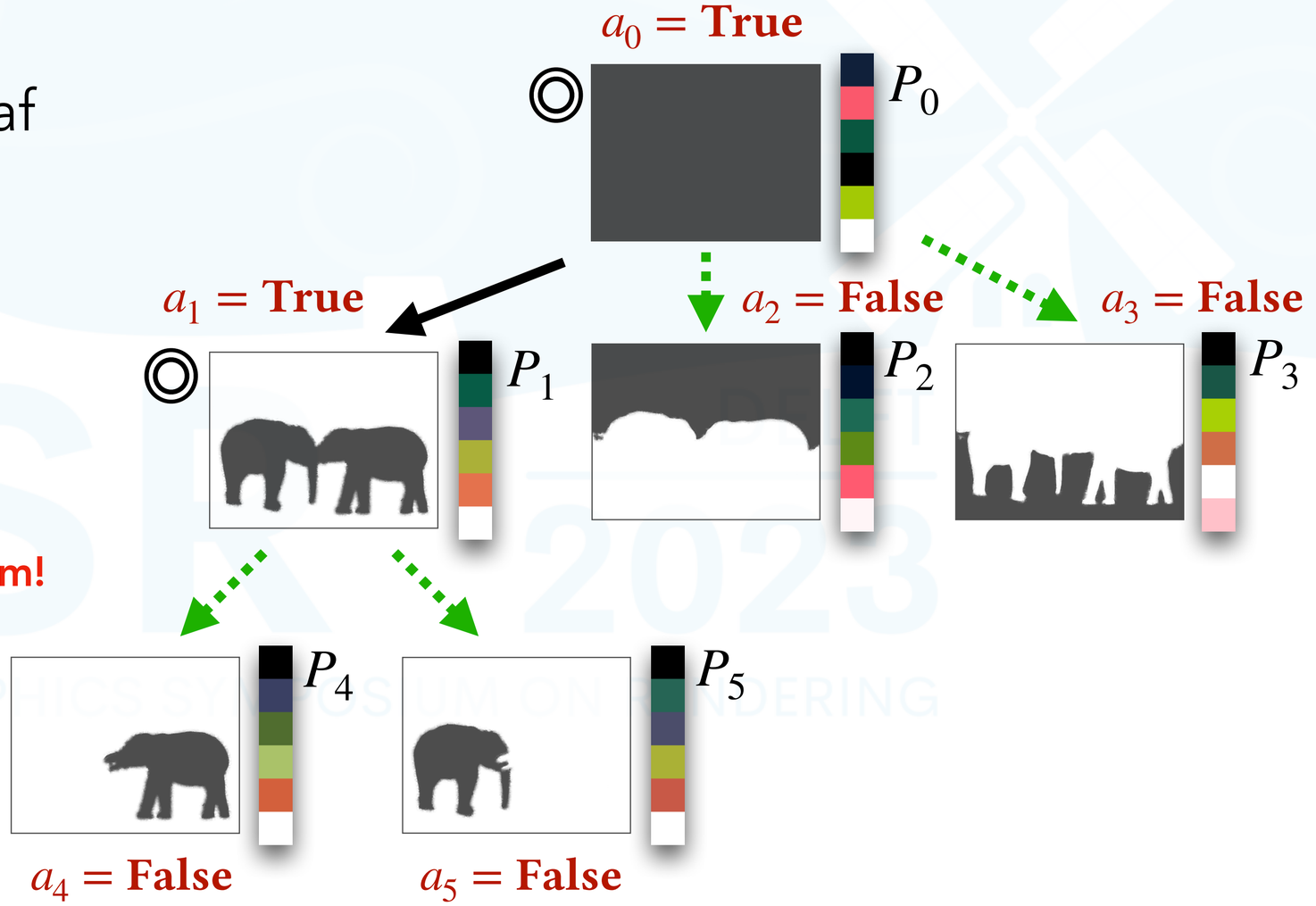


EGSR

DELFT

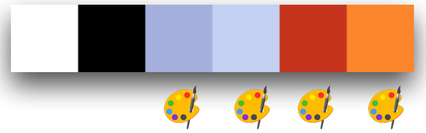
2023

THE 34TH EUROGRAPHICS SYMPOSIUM ON RENDERING

Input

Input

[Tan et al. 2018]



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LoCoPalettes

[Tan et al. 2018]

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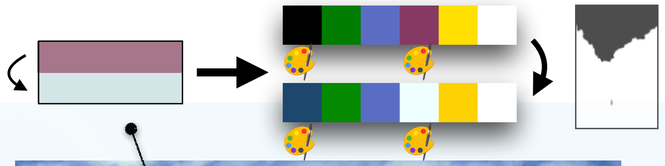

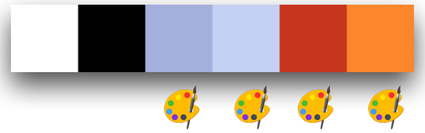

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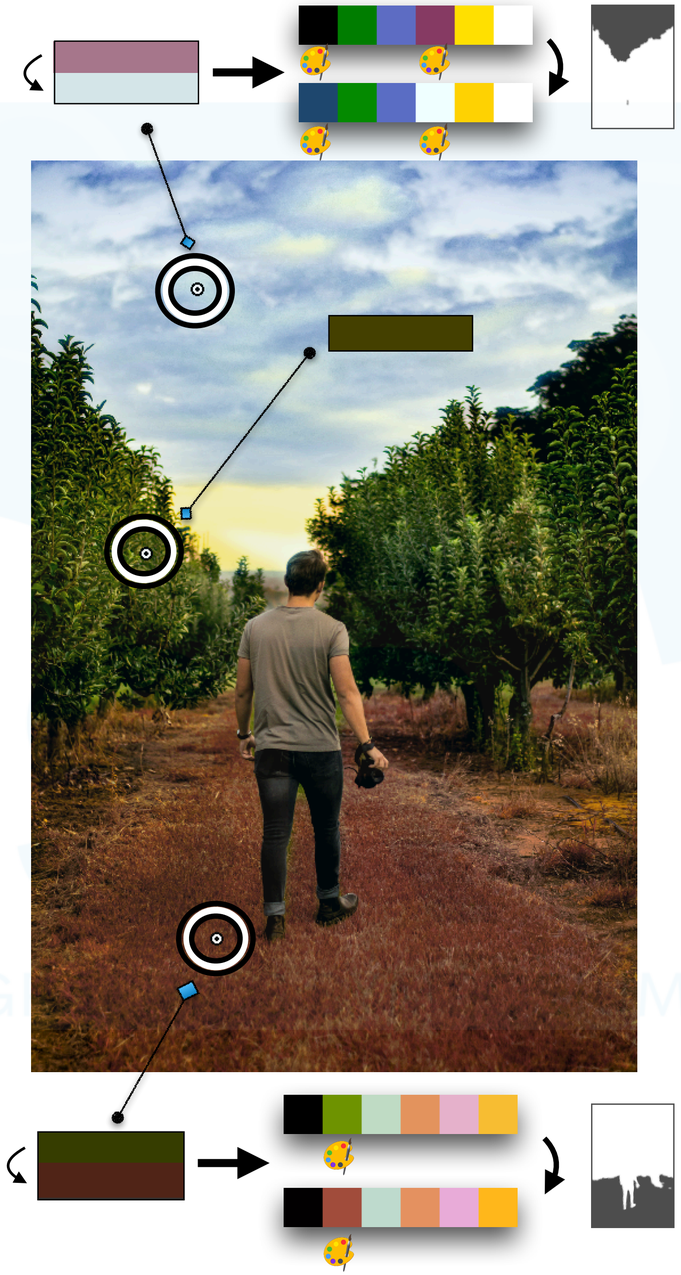

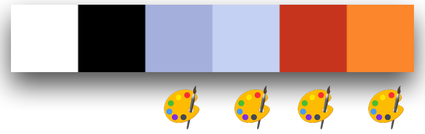

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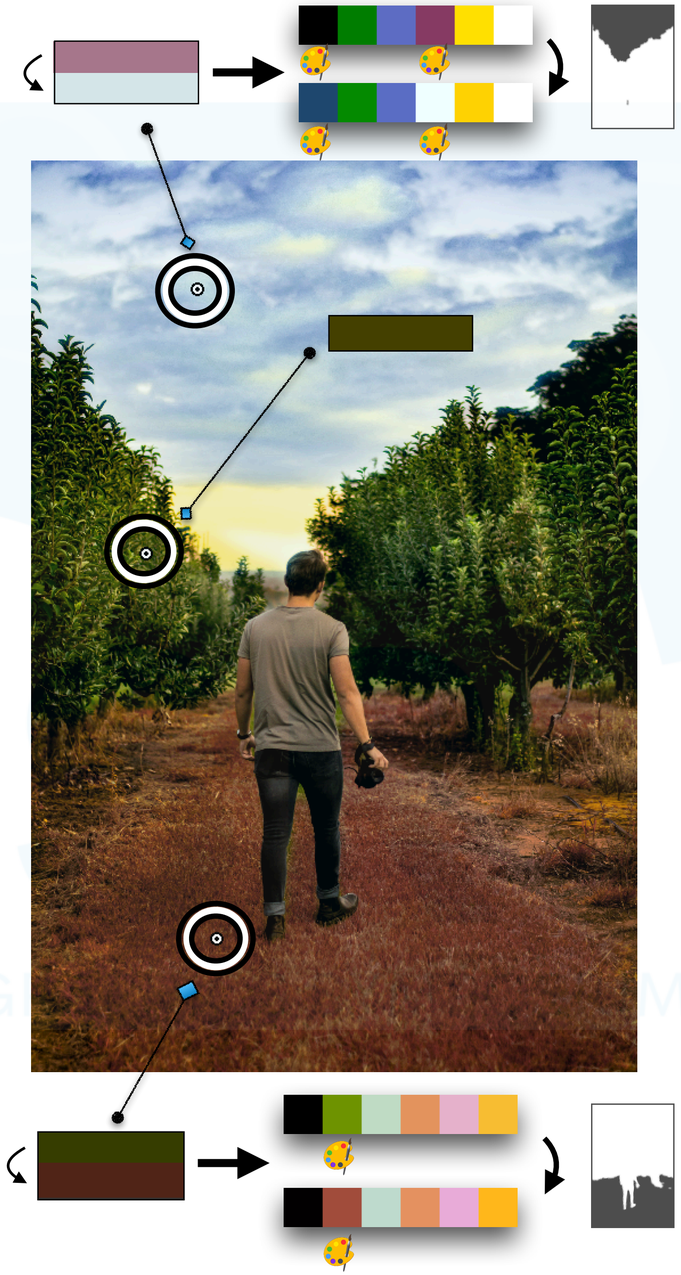
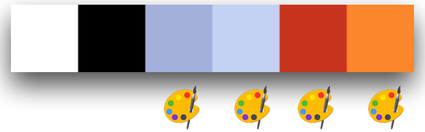


13× palette manipulations



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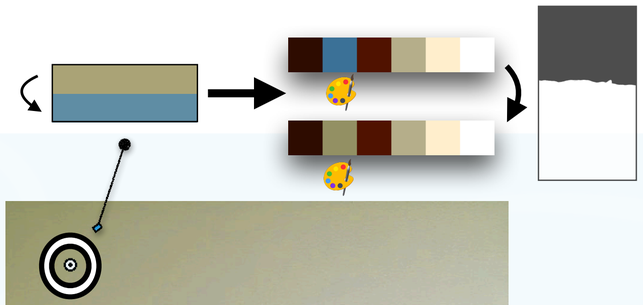

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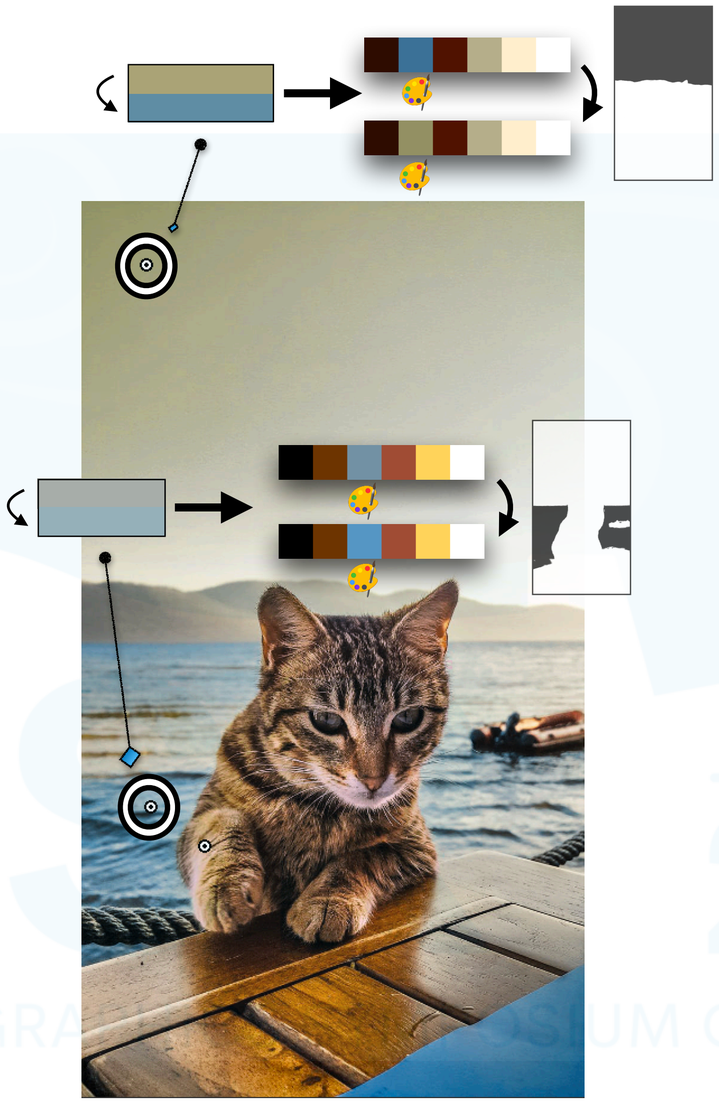

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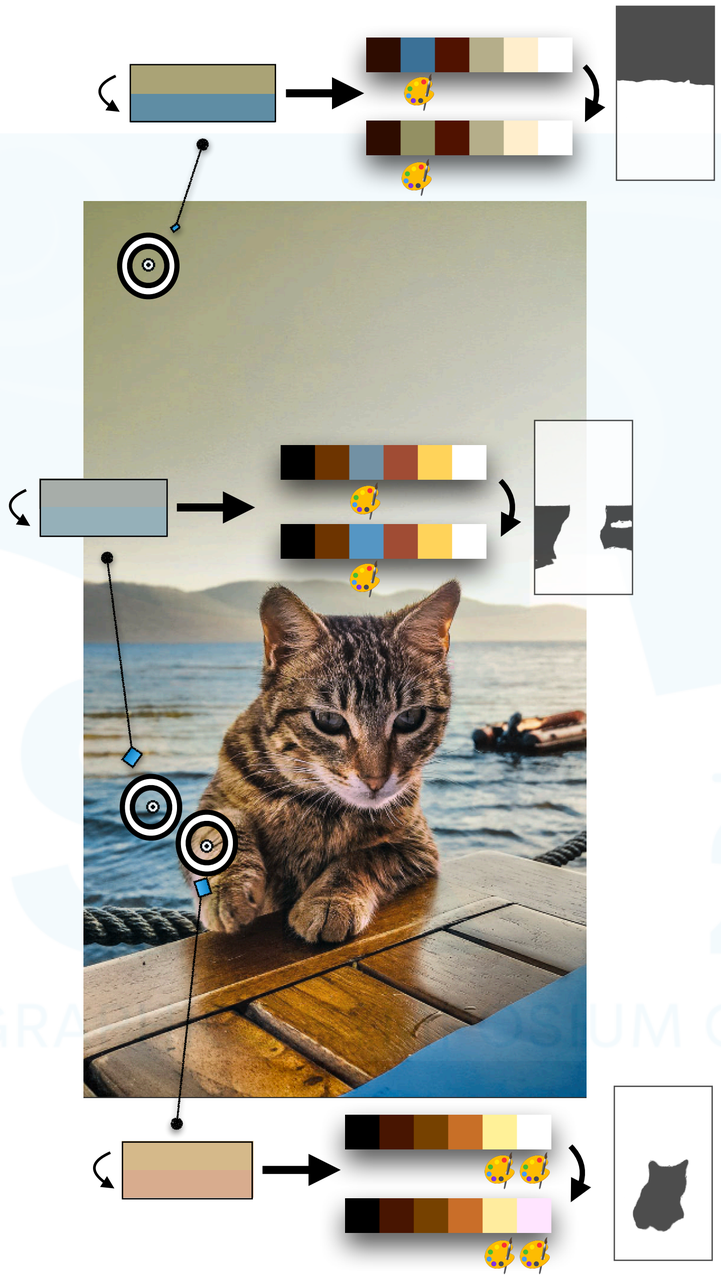

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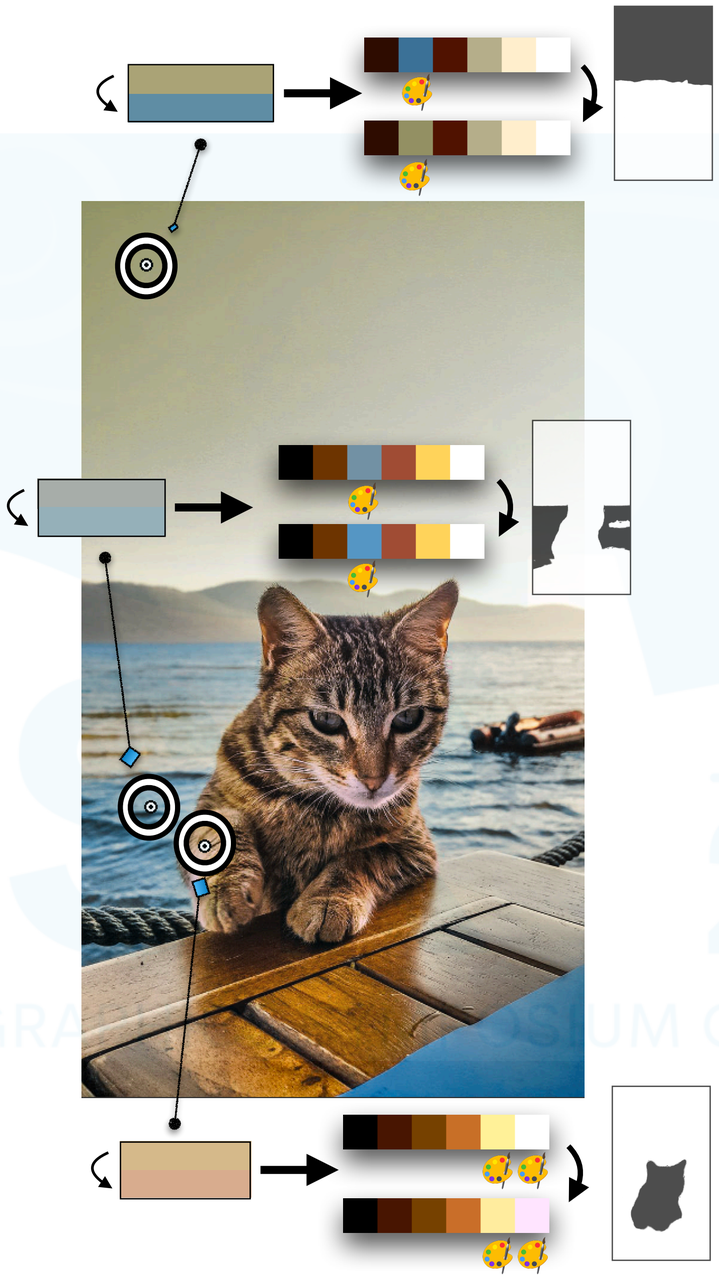

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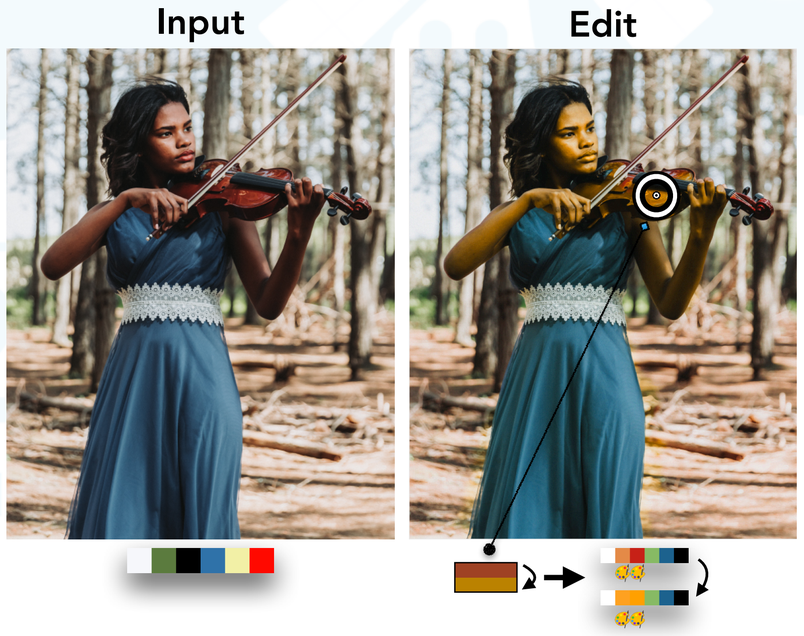

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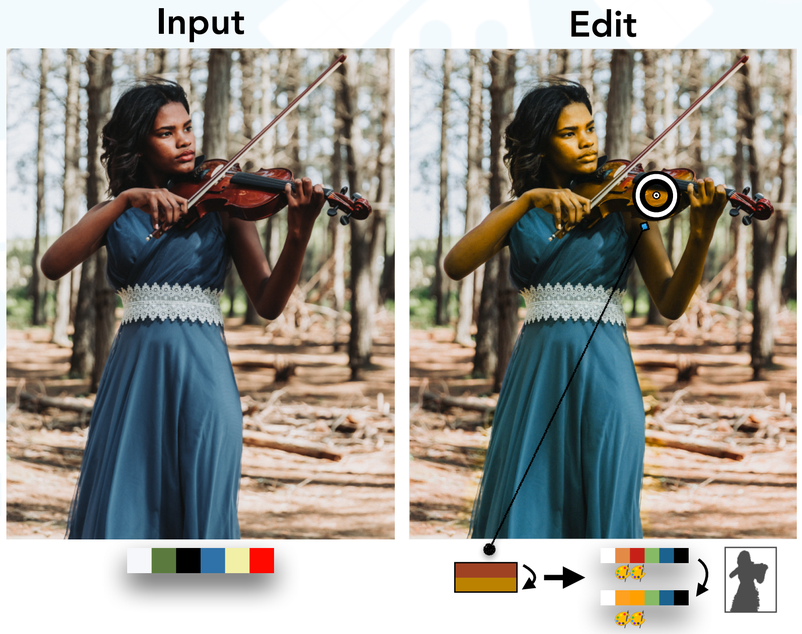

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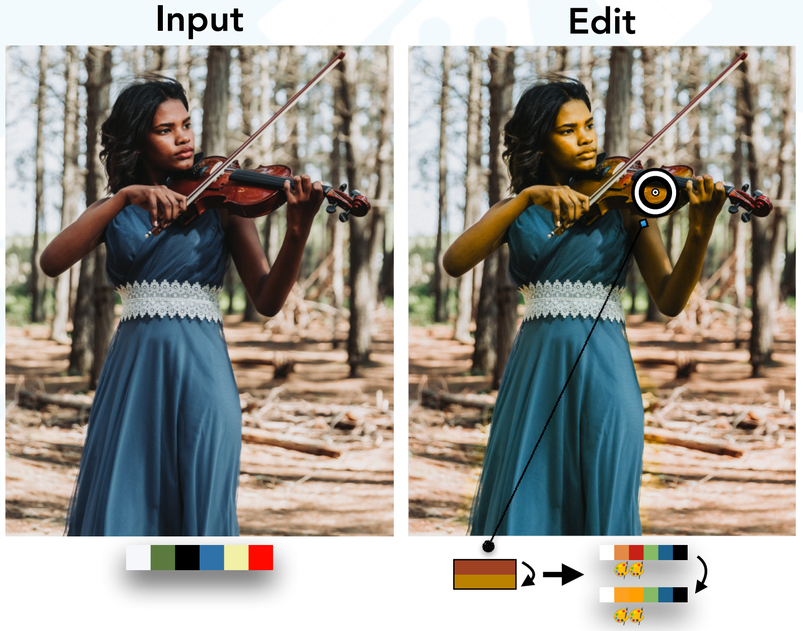

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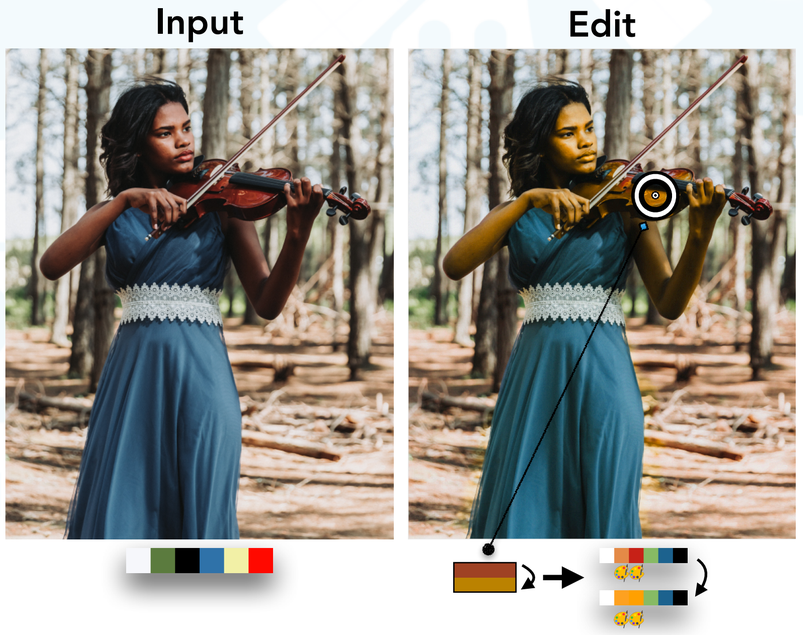

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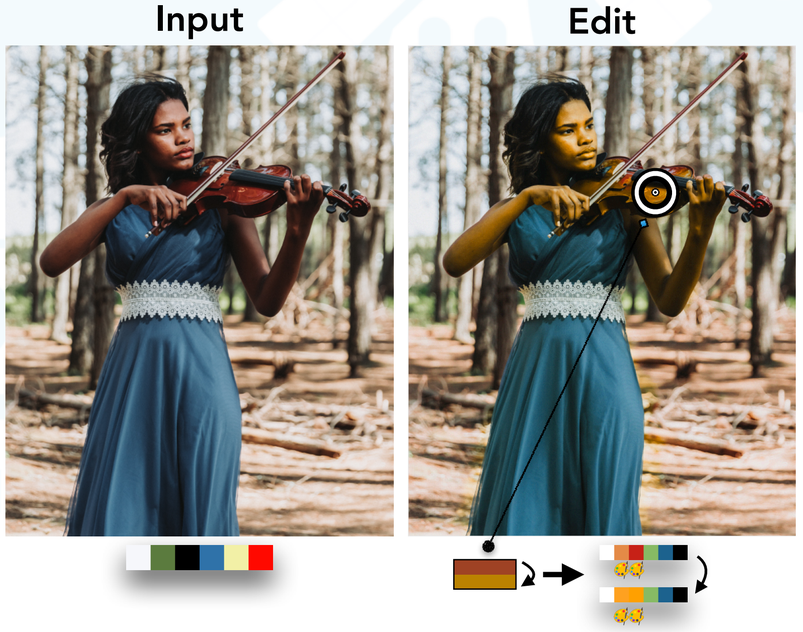

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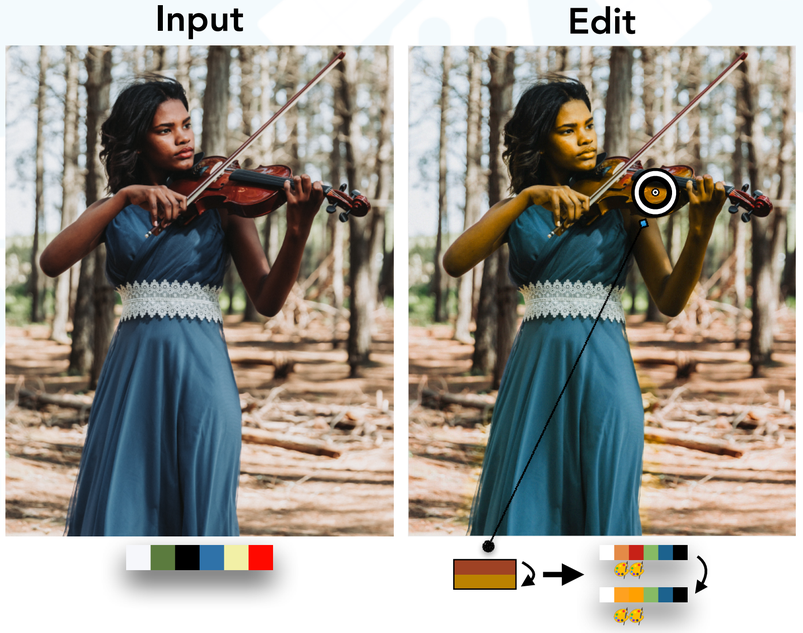

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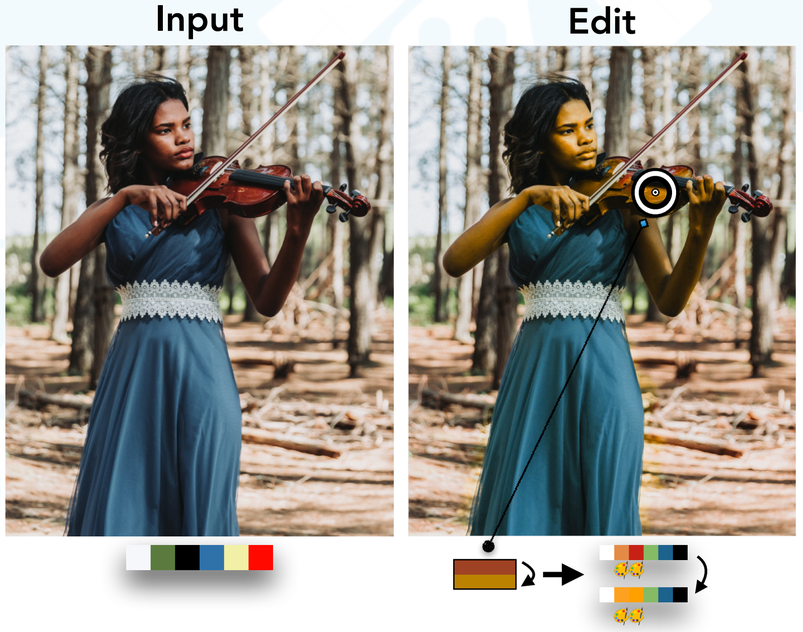

Thank you

- **Project page**: https://cragl.cs.gmu.edu/locopalettes/
- **Code and data**: https://github.com/tedchao/LoCoPalettes
- **Financial support**
  - Adobe

Evaluation

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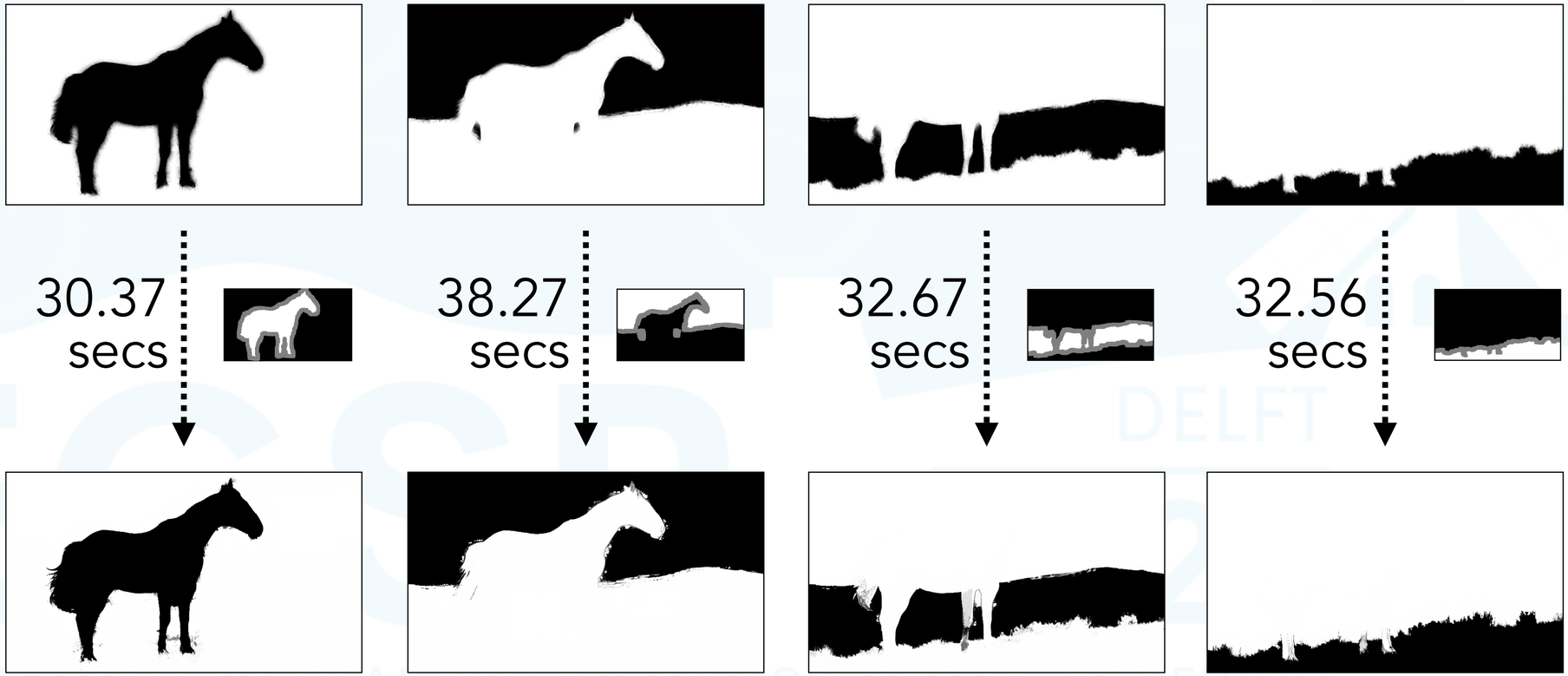

KNN Matting [Chen et al. 2013]

Sparsity Evaluation

Sparsity Estimate:	Tan et al. [2016]		Aksoy et al. [2017]	
Weights:	Tan et al. [2018]	Ours	Tan et al. [2018]	Ours
Mountain	0.2630	**0.2586**	1.3679	**1.2285**
Birds	0.2670	**0.2614**	1.5114	**1.3168**
Colorful	0.2549	**0.2511**	1.1242	**1.0245**
Boy	0.2676	**0.2638**	1.5325	**1.3966**