OUTLINE

RGBN
LINEAR EDITING
FILTERING
COMBINATION
ADDING FEATURES
NON-LINEAR EDITING
ONGOING WORK
RGBN
RGBN
APPLICATIONS

FANG 04
RGBN
CAPTURE

BERNARDINI 02
PROBLEM
PROBLEM
PROBLEM
PROBLEM

PROCESSING 🖍️
PROBLEM

VIDEO
PROBLEM
NORMALS AS GRADIENTS
NORMALS AS GRADIENTS

\[ \psi(x, y) = (x, y, z(x, y)) \]

\[ N = (n_1, n_2, n_3) \]
NORMALS AS GRADIENTS

$$\psi(x, y) = (x, y, z(x, y))$$

$$N = (n_1, n_2, n_3)$$

$$N(x, y) = \frac{\psi_x \times \psi_y}{|\psi_x \times \psi_y|} = \frac{(-z_x, -z_y, 1)}{\sqrt{z_x^2 + z_y^2 + 1}}$$
NORMALS AS GRADIENTS

\[ \psi(x, y) = (x, y, z(x, y)) \]

\[ N = (n_1, n_2, n_3) \]

\[ N(x, y) = \frac{\psi_x \times \psi_y}{|\psi_x \times \psi_y|} = \frac{(-z_x, -z_y, 1)}{\sqrt{z_x^2 + z_y^2 + 1}} \]

\[-n_1/n_3 = z_x, \quad -n_2/n_3 = z_y\]
FILTERING
FILTERING

OUR APPROACH

\[ N^z \ \rightarrow \ ? \ \rightarrow \ N^{z\cdot g} \]
FILTERING

OUR APPROACH

\[ N^z, N^g \]

\[ \rightarrow \]

\[ N^{z\times g} \]
FILTERING

OUR APPROACH

\[
\begin{align*}
z & \uparrow \\
\mathbb{Z}_x, \mathbb{Z}_y & \uparrow \\
N^z & \quad ? \\
N^{z*}\mathbb{g} &
\end{align*}
\]
FILTERING

OUR APPROACH

\[ z \xrightarrow{*g} z \ast g \]

\[ z_x, z_y \]

\[ N^z \xrightarrow{?} N^{z \ast g} \]
(z * g)x = (zx * g)
FILTERING

OUR APPROACH

\[ z \xrightarrow{\ast g} z \ast g \]
\[ z_x, z_y \xrightarrow{\ast g} (z \ast g)_x, (z \ast g)_y \]
\[ N^z \xrightarrow{?} N^{z \ast g} \]

\[ (z \ast g)_x = (z_x \ast g) \]
FILTERING

OUR APPROACH

\[ N^z \xrightarrow{\star g} (z \star g)_x, (z \star g)_y \xrightarrow{N} N^{z\star g} \]
FILTERING
BLUR
FILTERING INPUT
FILTERING

EDGE ENHANCEMENT
FILTERING
HIGH-PASS
FILTERING

HIGH-PASS
COMBINATION
COMBINATION

OUR APPROACH

\[ N^{h_1} \rightarrow \nabla h_1 \]
\[ N^{h_2} \rightarrow \nabla h_2 \]
\[ \nabla h_1 + \nabla h_2 = \nabla (h_1 + h_2) \rightarrow N^{h_1+h_2} \]
COMBINATION

STAMP
COMBINATION

STAMP
ADDING FEATURES
ADDING FEATURES

FEATURE DESIGN

[Image of a zucchini with features]
ADDING FEATURES

FEATURE DESIGN

\[ \phi : \mathbb{R}^2 \rightarrow \mathbb{R}^2 \]
ADDING FEATURES

FEATURE DESIGN

\[ \phi : \mathbb{R}^2 \to \mathbb{R}^2 \]
\[ h : \mathbb{R}^2 \to \mathbb{R} \]
\[ h \circ \phi : \mathbb{R}^2 \to \mathbb{R} \]
\[ \nabla (h \circ \phi) = \nabla h \cdot D\phi = \]
\[
\left( \frac{\partial h}{\partial u} \quad \frac{\partial h}{\partial v} \right) \left( \begin{array}{cc}
\frac{\partial u}{\partial x} & \frac{\partial u}{\partial y} \\
\frac{\partial v}{\partial x} & \frac{\partial v}{\partial y}
\end{array} \right)
\]

\[ \phi : \mathbb{R}^2 \to \mathbb{R}^2 \]
\[ h : \mathbb{R}^2 \to \mathbb{R} \]
\[ h \circ \phi : \mathbb{R}^2 \to \mathbb{R} \]
ADDING FEATURES

FEATURE DESIGN

\[ h(u, v) \]

\[ \phi \]

\[ R \]

\[ M \]

\[ C \]

\[ x \]

\[ y \]
RESULTS

ADDITION FEATURES
NON-LINEAR EDITING
NON-LINEAR EDITING

NON-LINEAR COMBINATION
NON-LINEAR EDITING

NON-LINEAR COMBINATION

\[ \text{Diagram} \]
NON-LINEAR EDITING

NON-LINEAR COMBINATION
NON-LINEAR EDITING

NON-LINEAR COMBINATION
NON-LINEAR EDITING
NON-LINEAR COMBINATION
NON-LINEAR EDITING

RESULTS
NON-LINEAR EDITING

RESULTS
LIMITATIONS

IMAGE ONLY
LINEAR FILTERS
COMBINATION REQUIRES NULL EXTENSION
ORTHOGONAL PROJECTION
ONGOING WORK
ONGOING WORK

NORMAL SYNTHESIS

Low Pass

High Pass

Texture Synthesis
ONGOING WORK

NORMAL SYNTHESIS
ONGOING WORK

NORMAL SYNTHESIS
ONGOING WORK
NORMAL SYNTHESIS
ONGOING WORK

NORMAL SYNTHESIS
ONGOING WORK

SKETCH-BASED RGBN WARPING
ONGOING WORK

SKETCH-BASED RGBN WARPING
ONGOING WORK

SKETCH-BASED RGBN WARPING
ONGOING WORK
NORMAL MAP EDITING
ONGOING WORK

PROJECTIVE ATLAS
ONGOING WORK
PROJECTIVE ATLAS
ONGOING WORK
PROJECTIVE ATLAS
ONGOING WORK

OVERLAPS
ONGOING WORK
NORMAL MAP EDITING
ONGOING WORK
NORMAL MAP EDITING
ONGOING WORK
NORMAL MAP EDITING
ONGOING WORK
NORMAL MAP EDITING
THANK YOU!

ANY QUESTIONS?