ENDING & BEGINNING

Yue Shichao

OUTLINE

- Project History
- Current Achievements
- Future Plans

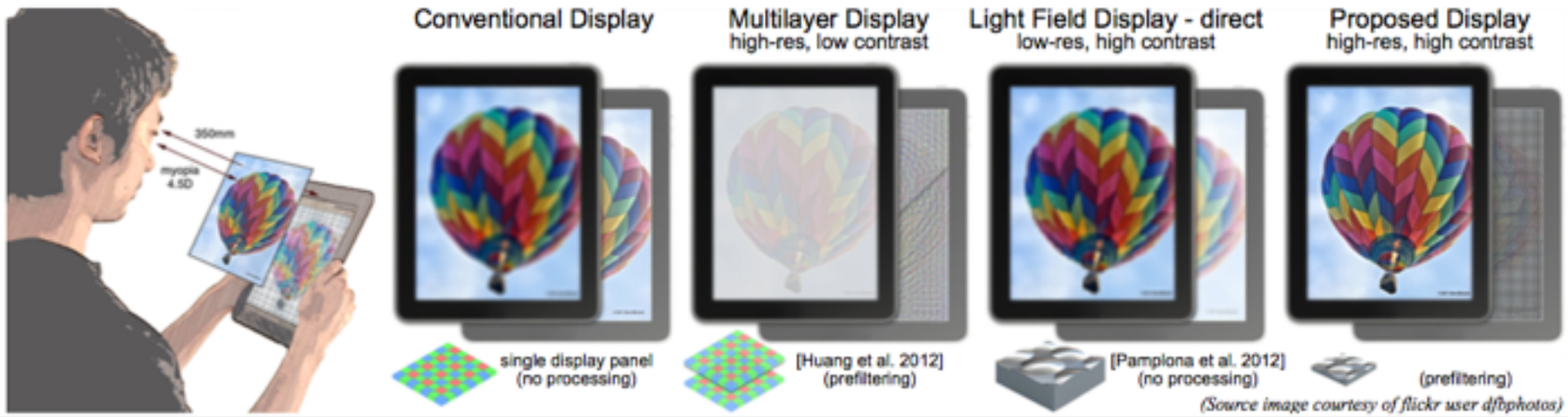
PROJECT HISTORY

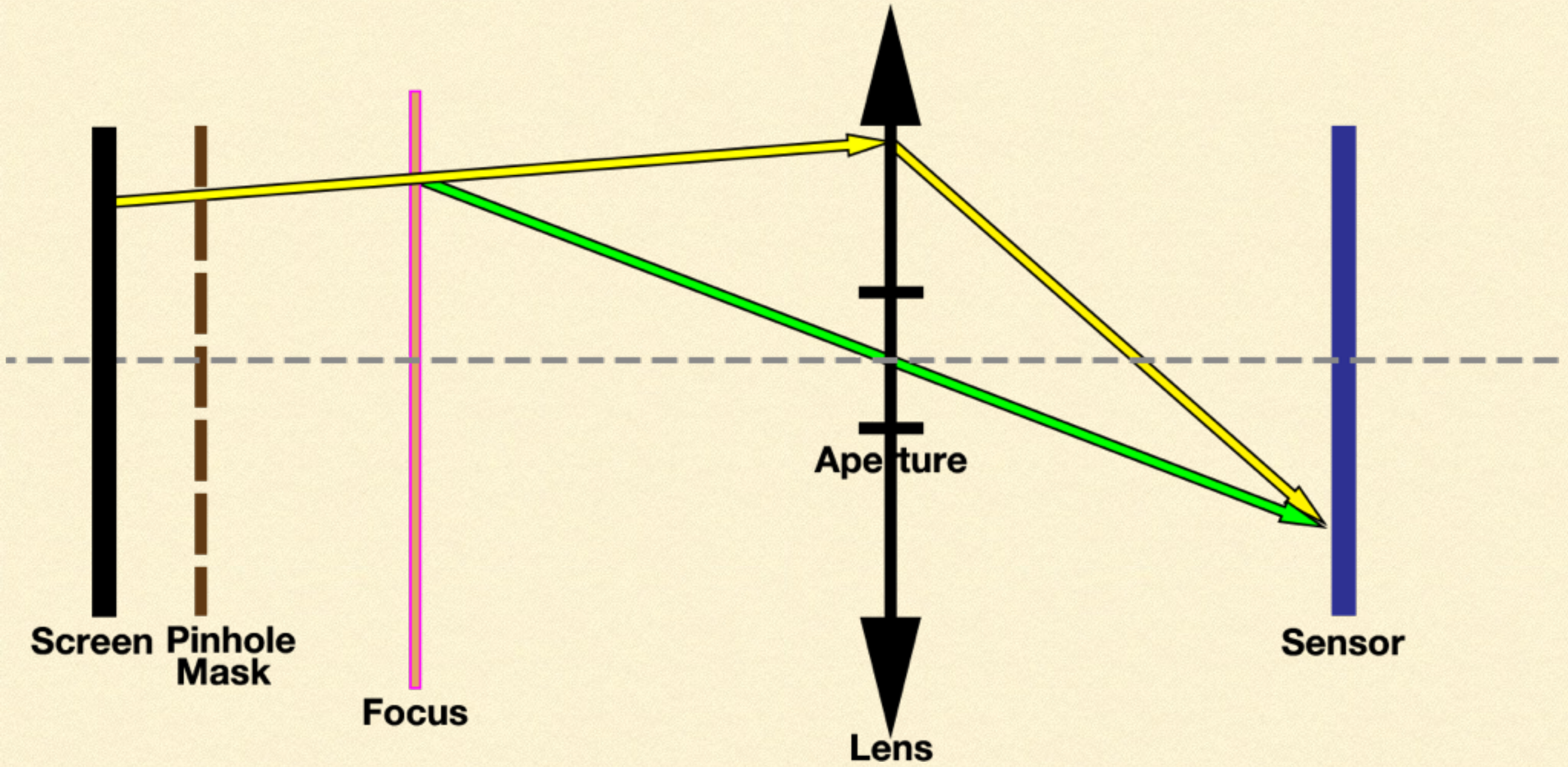
- Eyeglasses-free display: towards correcting visual aberrations with computational light field displays *ACM Trans. Graph. (Proc. SIGGRAPH), vol. 33, no. 4, pp. 1-12, July 2014.*

Eyeglasses-free Display: Towards Correcting Visual Aberrations with Computational Light Field Displays

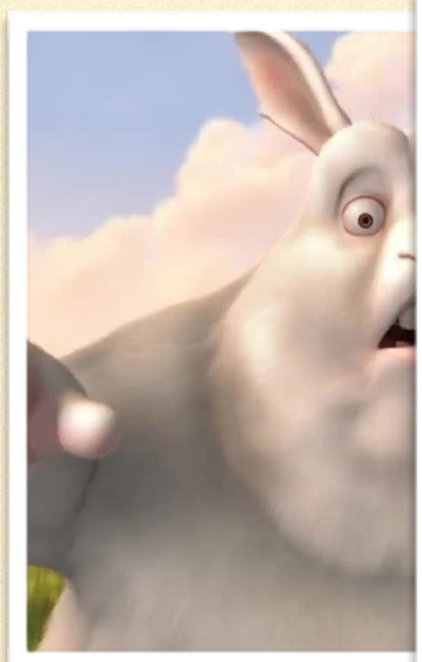
Fu-Chung Huang[1,4] Gordon Wetzstein[2] Brian A. Barsky[1,3] Ramesh Raskar[2]

[1]Computer Science Division, UC Berkeley [2]MIT Media Lab [3]School of Optometry, UC Berkeley [4]Microsoft Corporation




Screen
Pinhole Mask
Focus
Aperture
Lens
Sensor

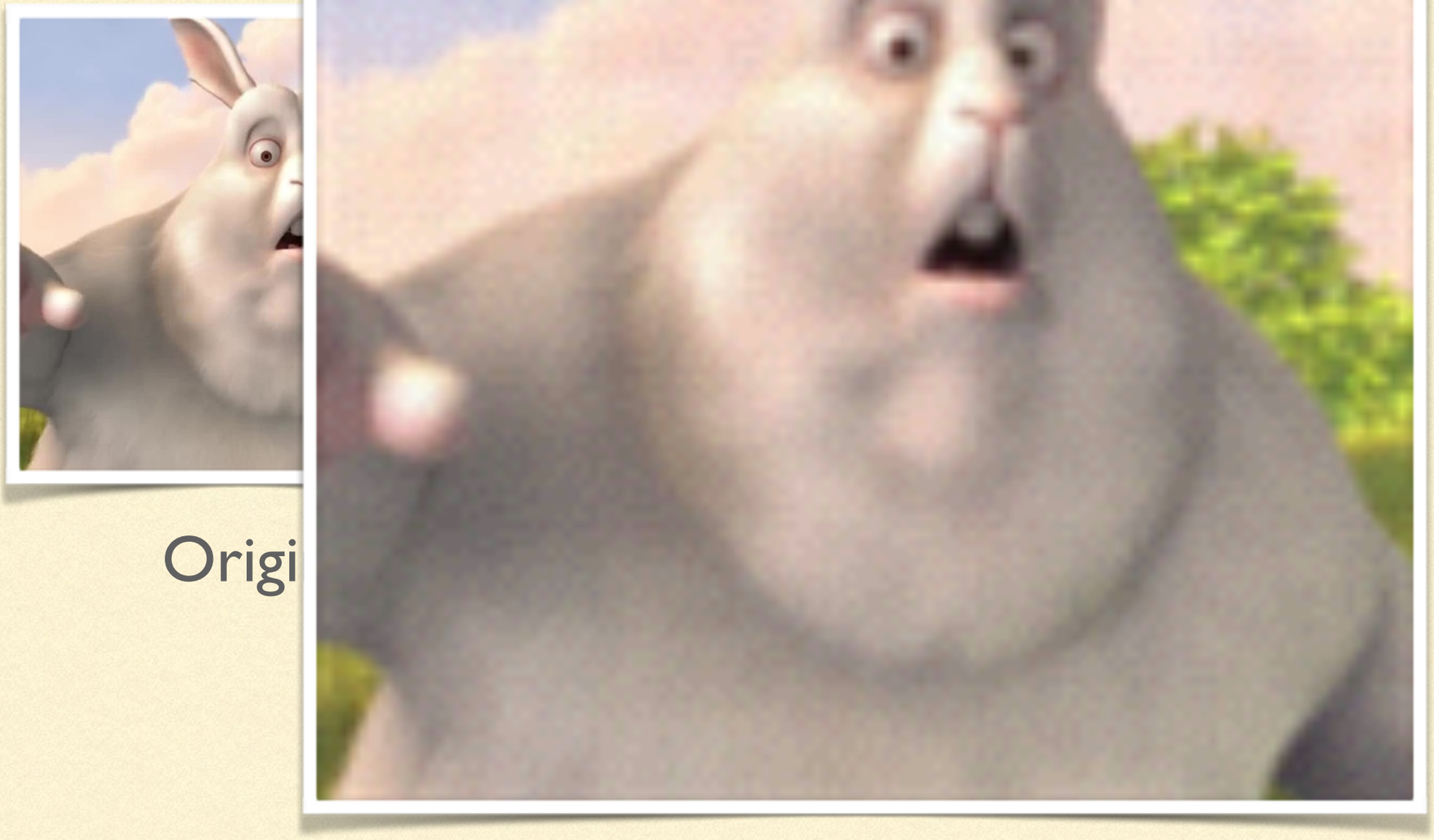
Origin



Origin

Origin

Prefilted



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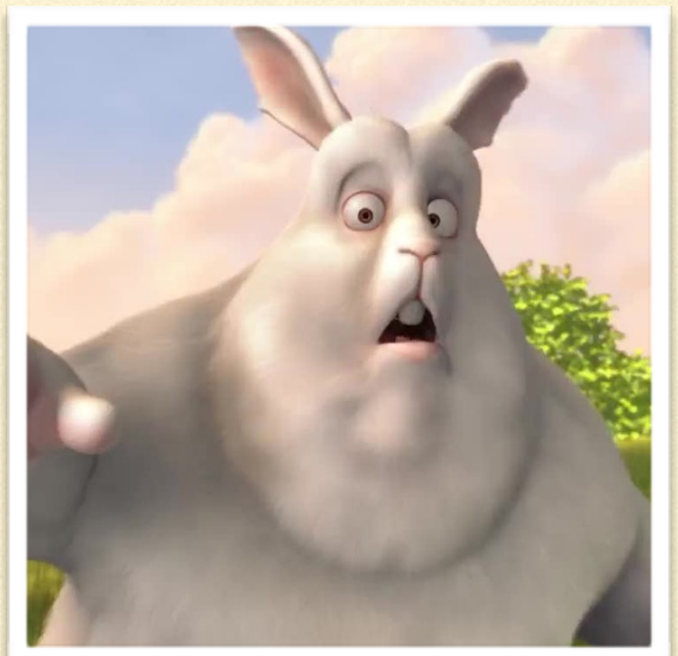
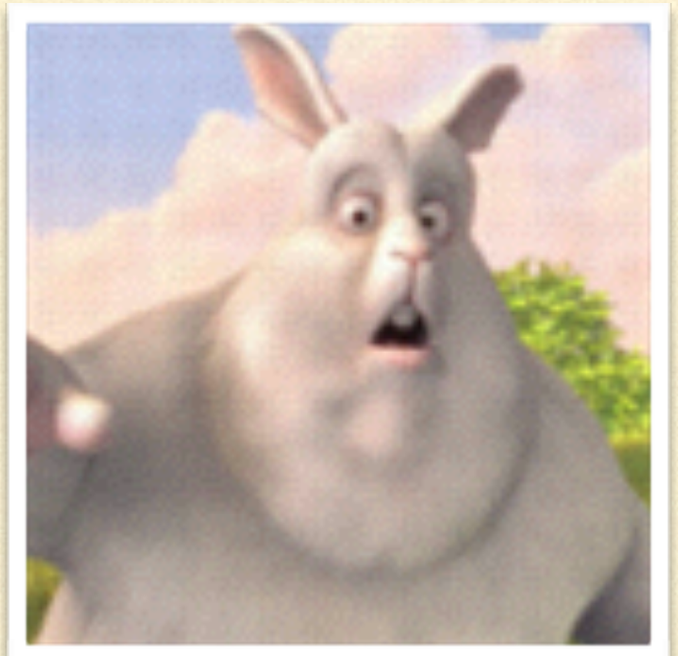


Origin

Prefilted



Perceived

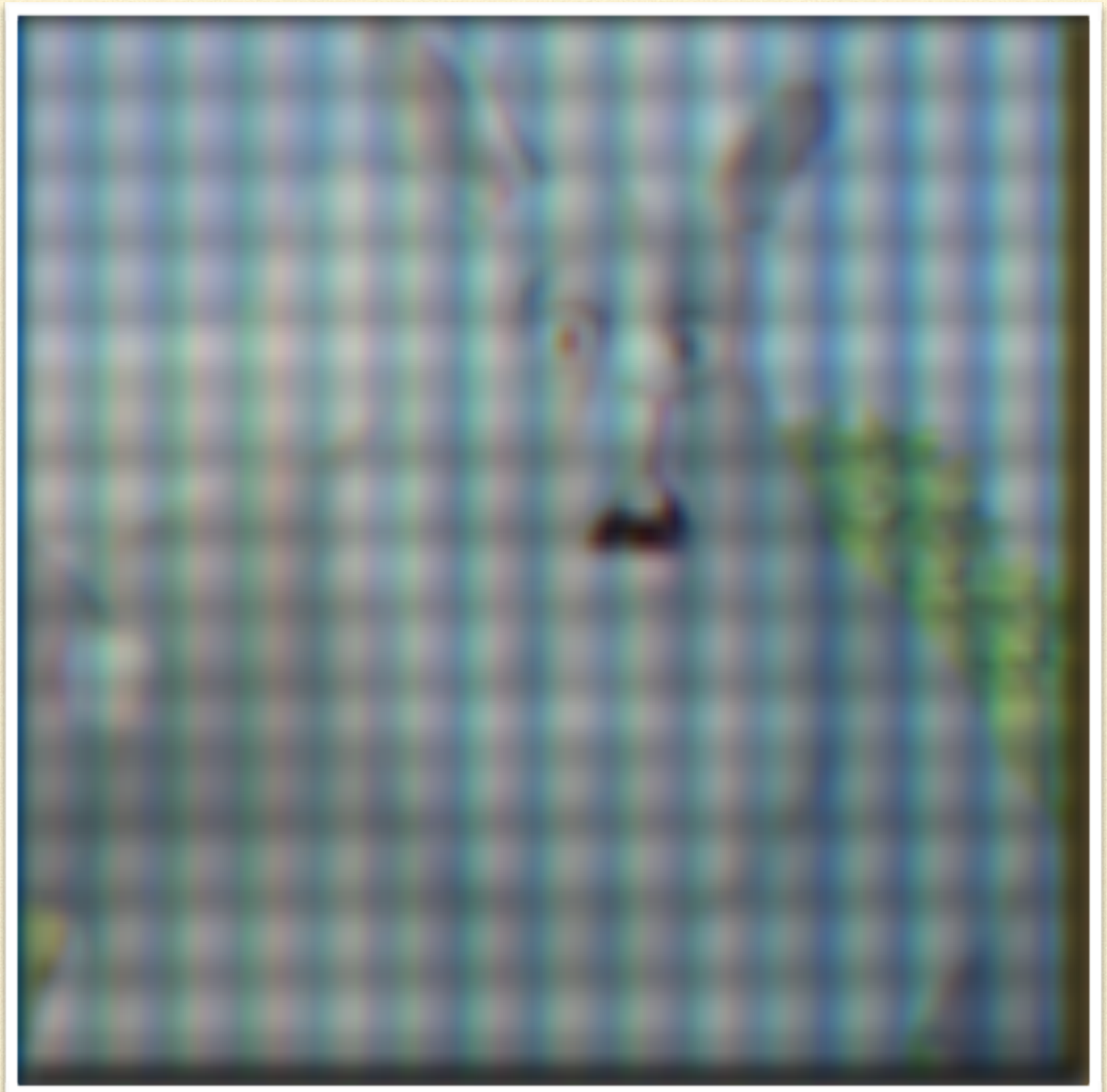
FEATURES

- Light Field Display + Prefilted Image
- Prefilted Image is given by a large system of linear equations
- Off-Axis Optimization

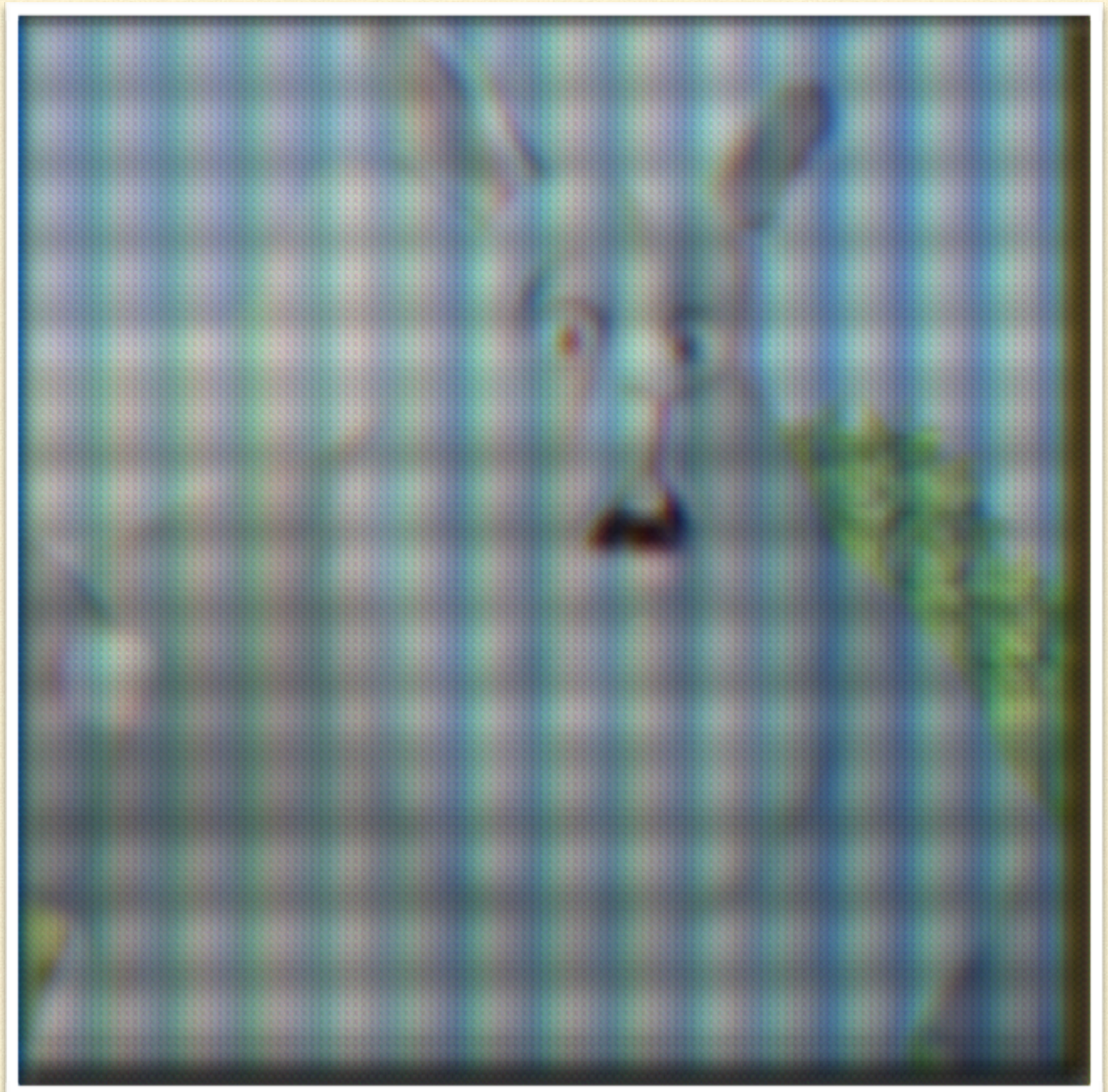
DRAWBACKS

- Extremely Low Brightness
- Extremely Slow and Unstable Solving Speed, Introduce Error
- Great Resolution Degradation (1/5)
- Defocus Only. Worse than origin if defocus is not severe
- Sensor Pixel Size and Screen RGB Sub pixel is not considered

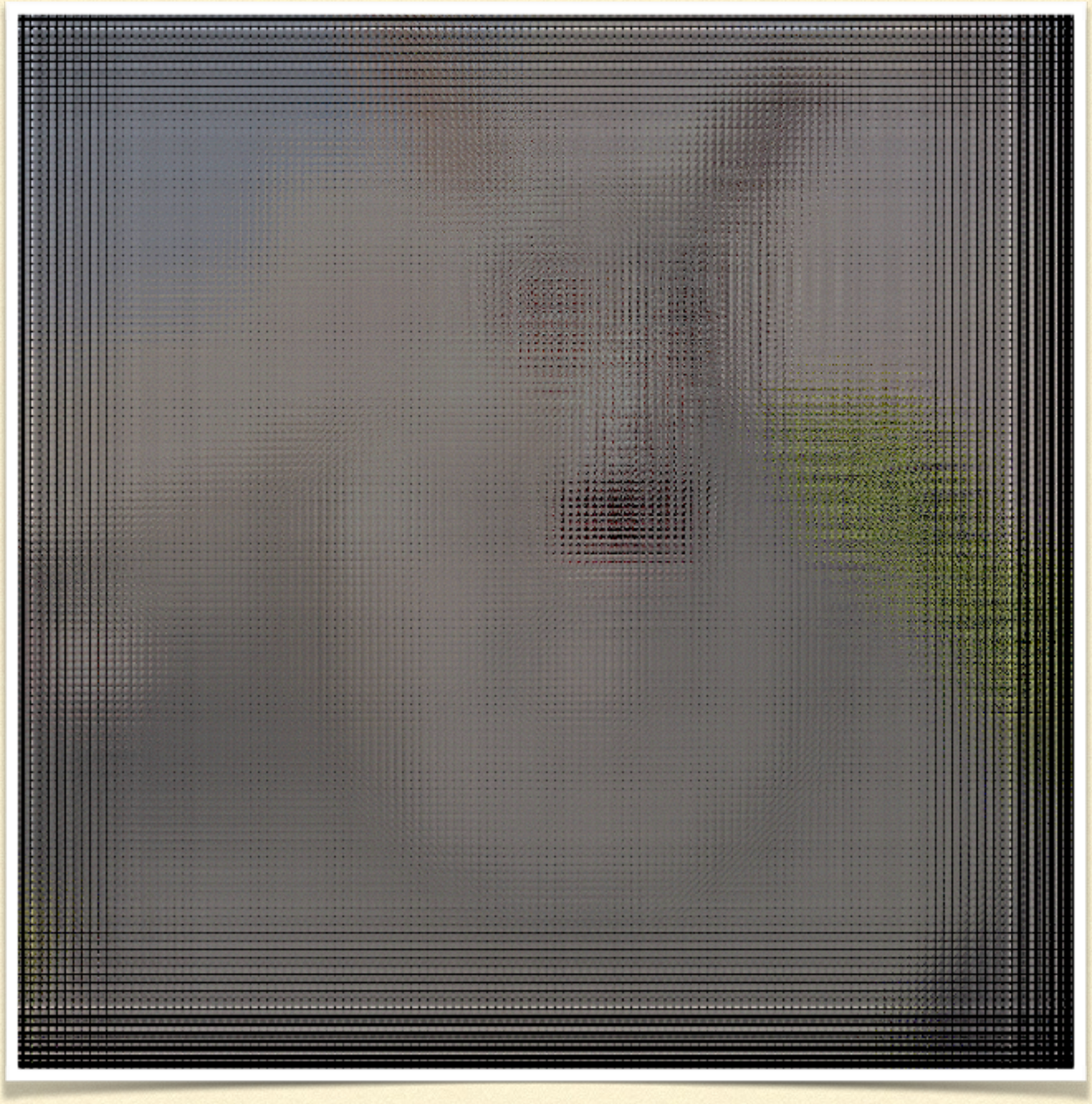
128
x
128



640
x
640



Multi
View



HISTORICAL ATTEMPTS

- Higher Order Aberration (Huang)
- From Backward Sampling To Forward Mapping (Fu)
- Immigrate from Matlab To C++ (Kevin & Peter)
- Pseudo Inverse Matrix (Kevin)

CURRENT ACHIEVEMENTS

- Code Structure
- Multi-Threading
- Optic Computation
- iOS

CODE STRUCTURE

- C++ Object Oriented Programming
- Google Coding Style
- Optimization
- 1000x Faster
- Easier to maintain

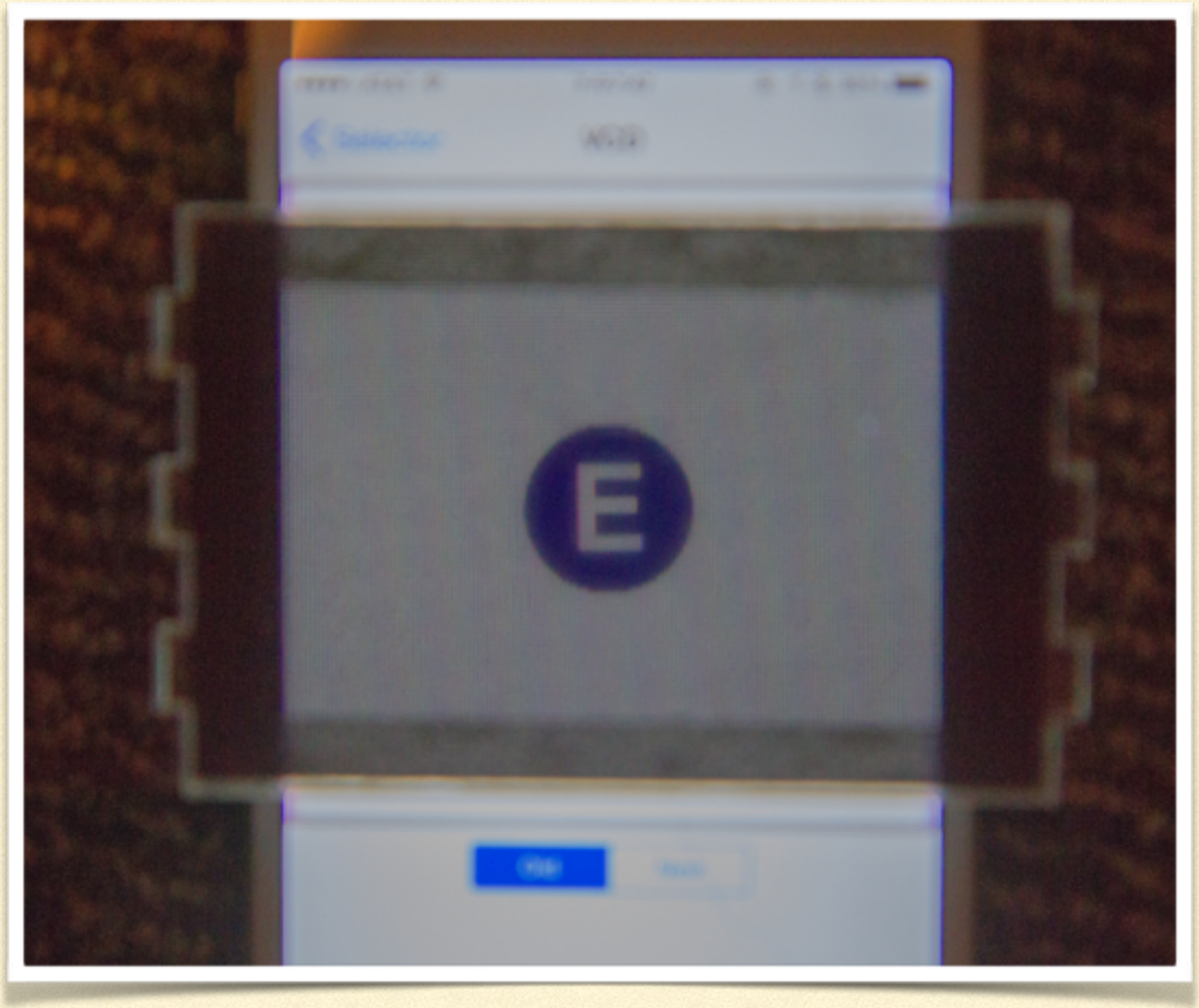
MULTI-THREADING

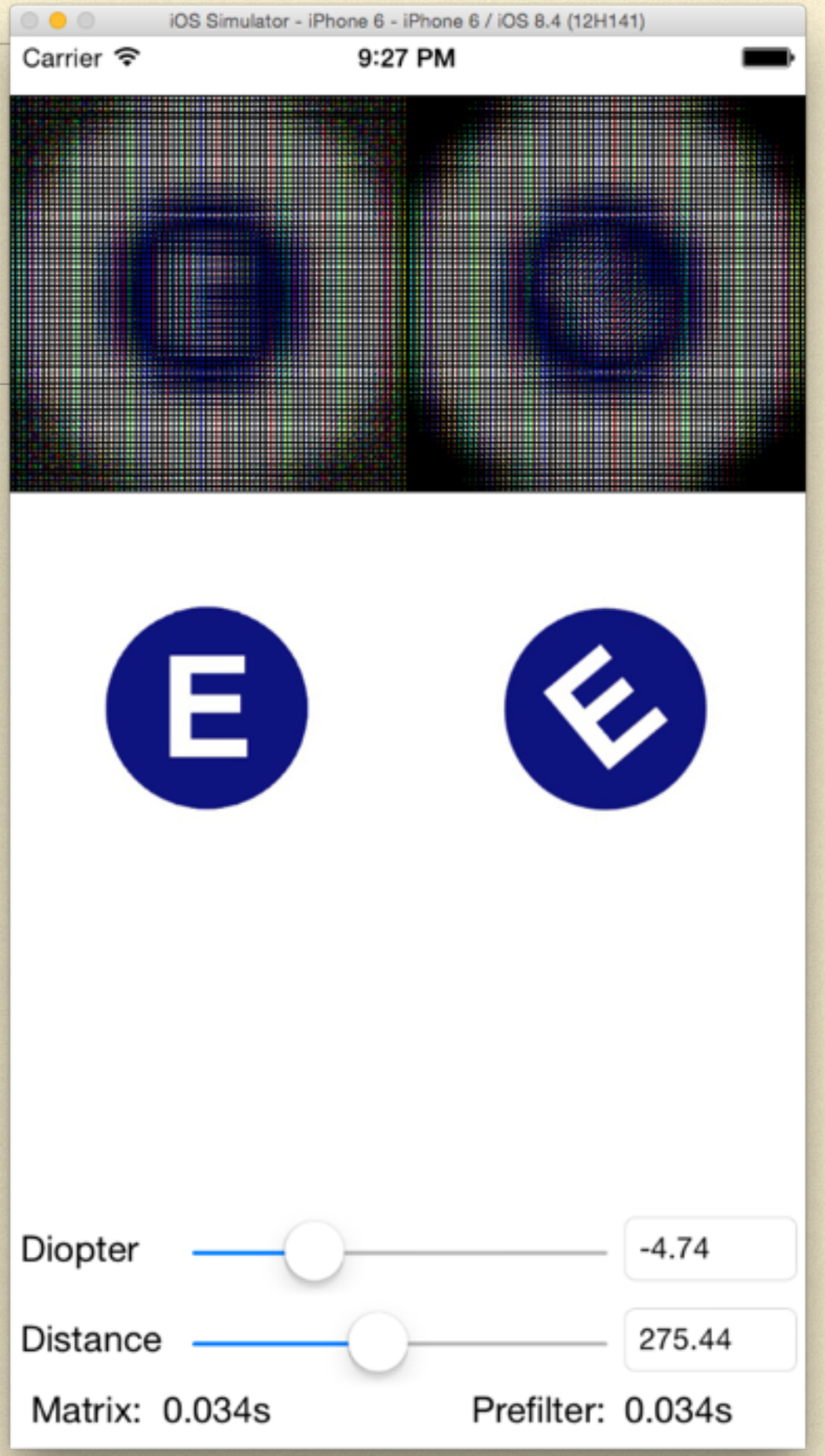
- std::thread
- Heading to OpenCL

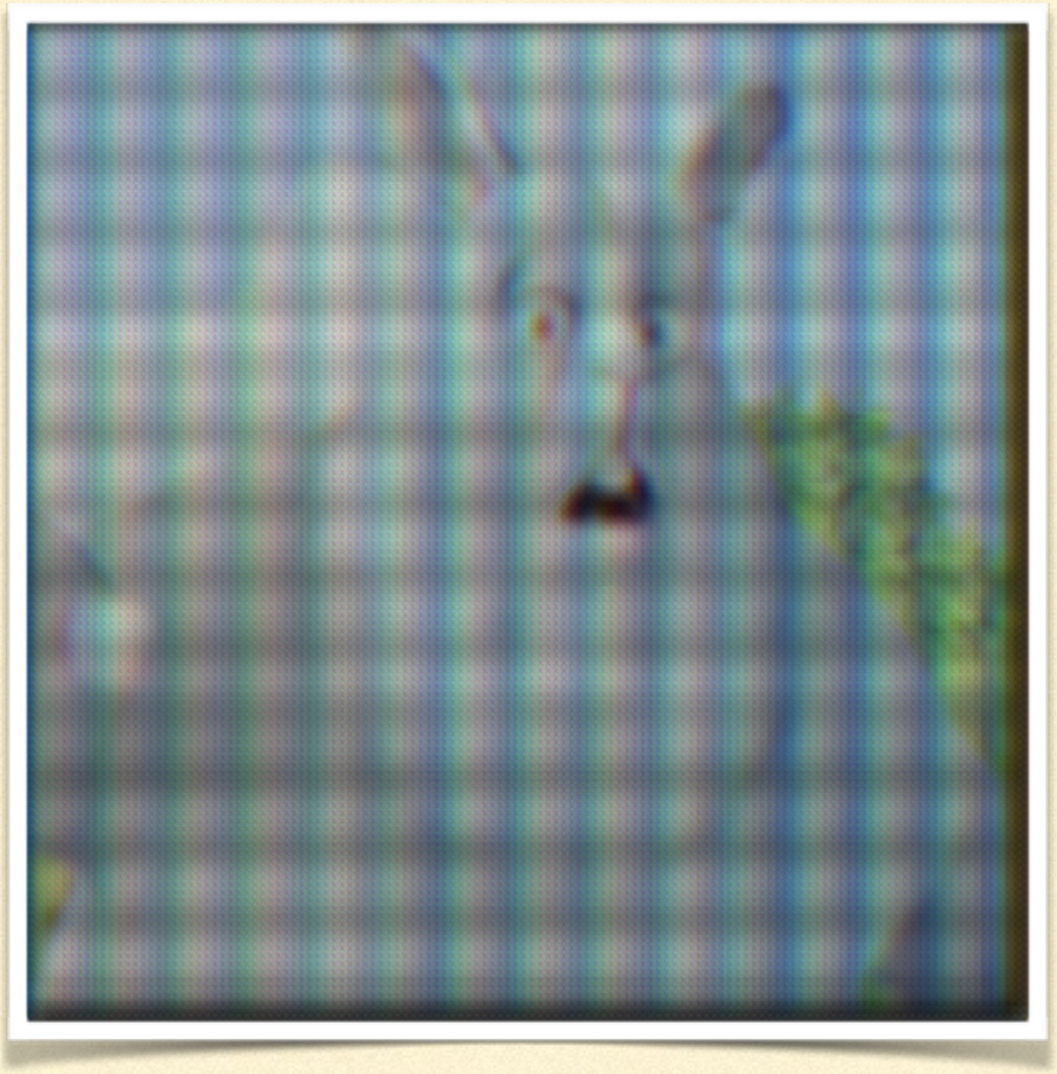
PREFILTER ALGORITHM

- Based on pure ray tracing.
- Complexity Reduced.
- No more equations.
- Defocus only. Heading to astigmatism.
- Treat RGB separately. RGB Effect is reduced but not erased
- Based on center sampling. Error exists here.

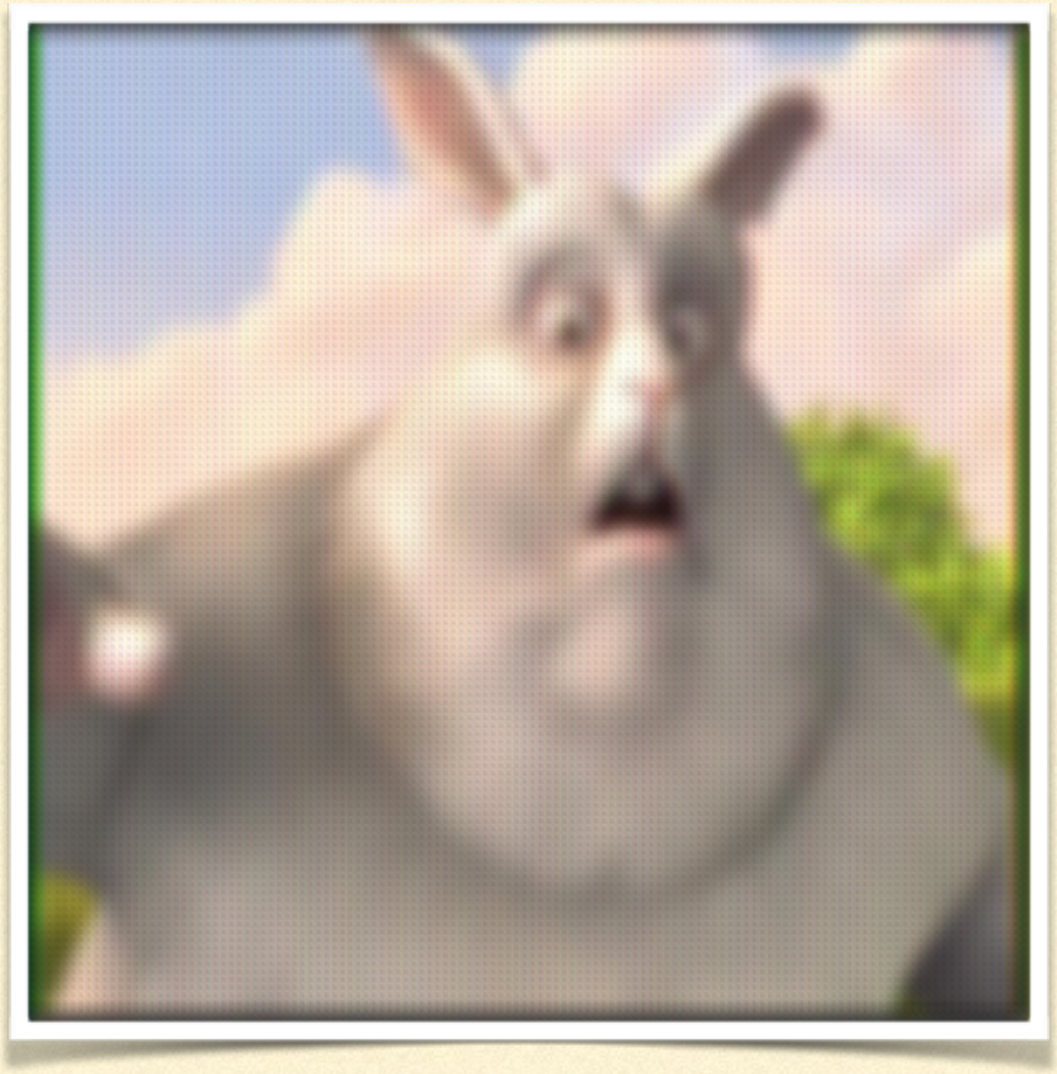
IOS APPLICATION



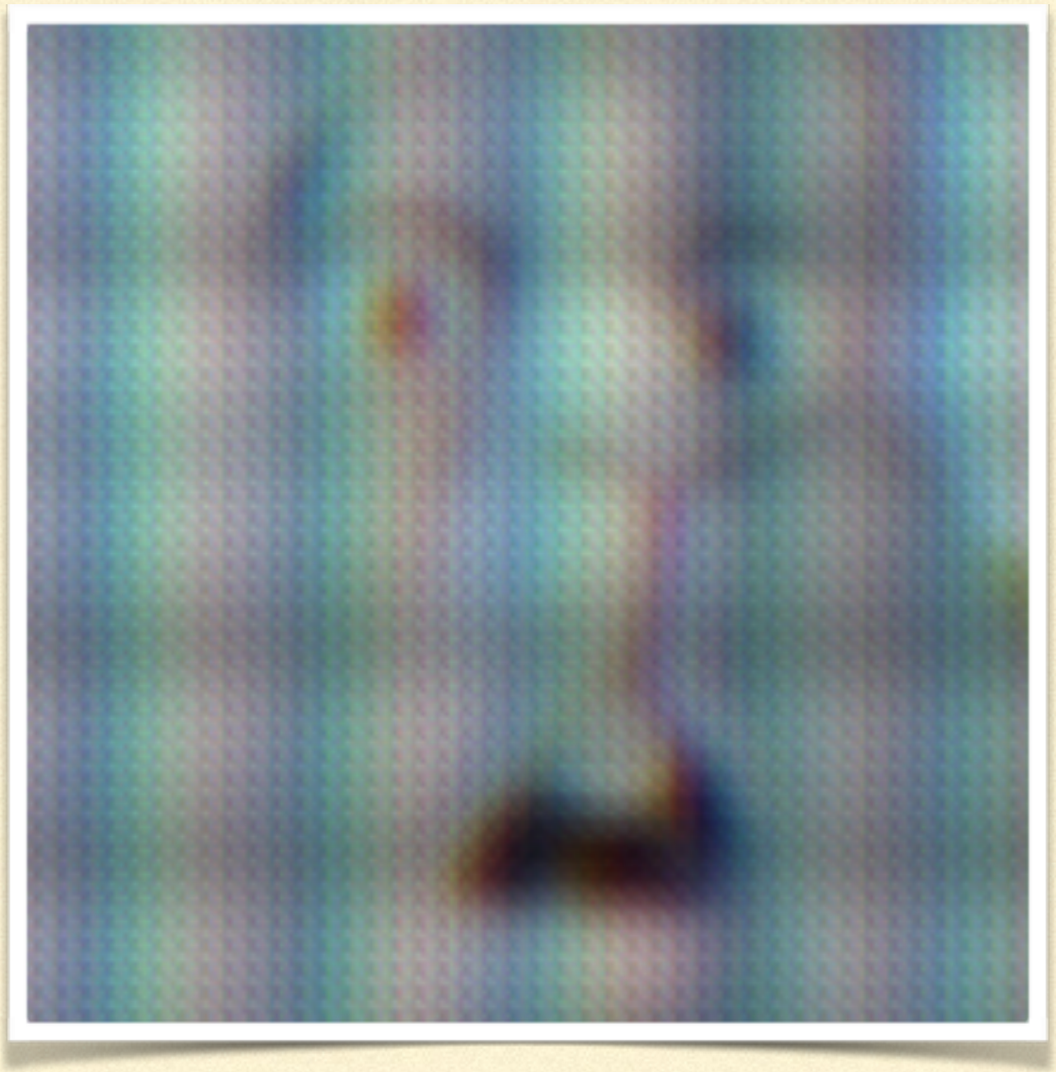




Version - Huang



Version - Yue



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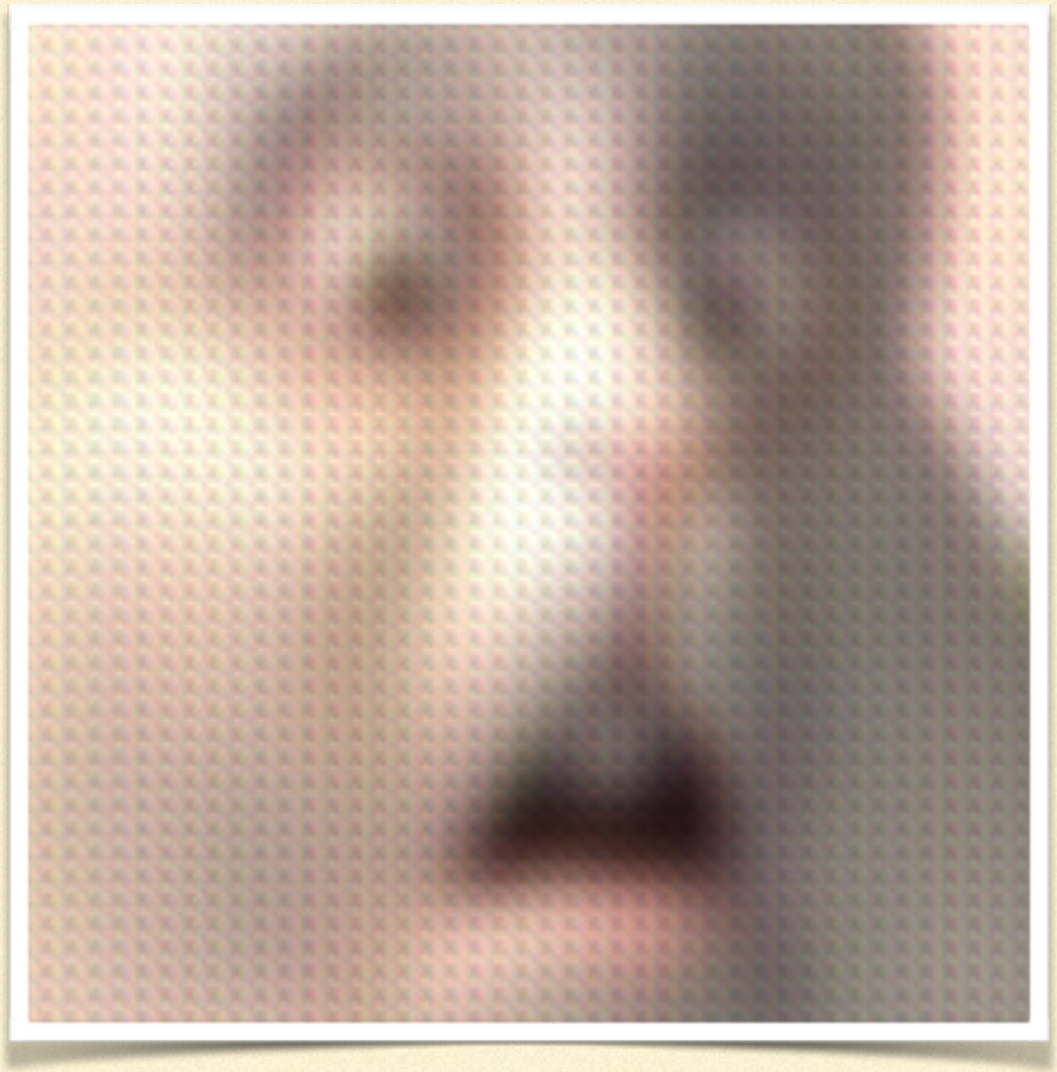

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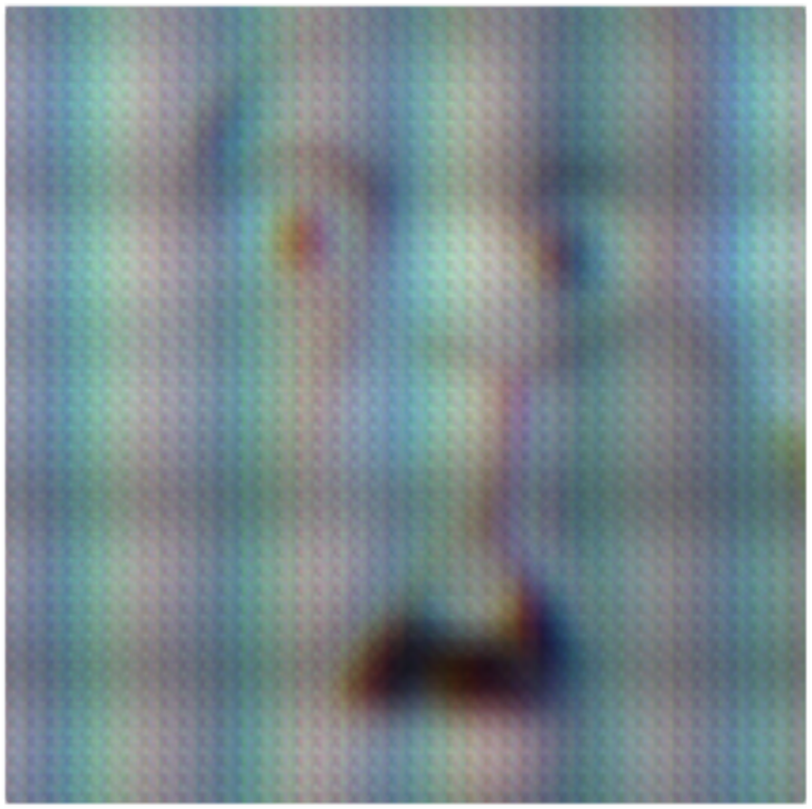

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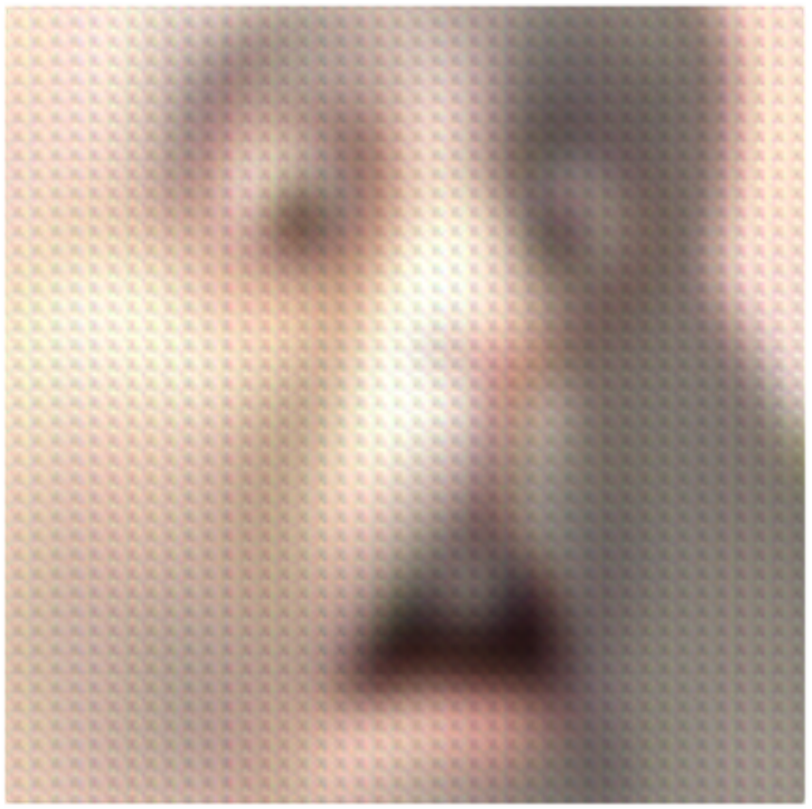

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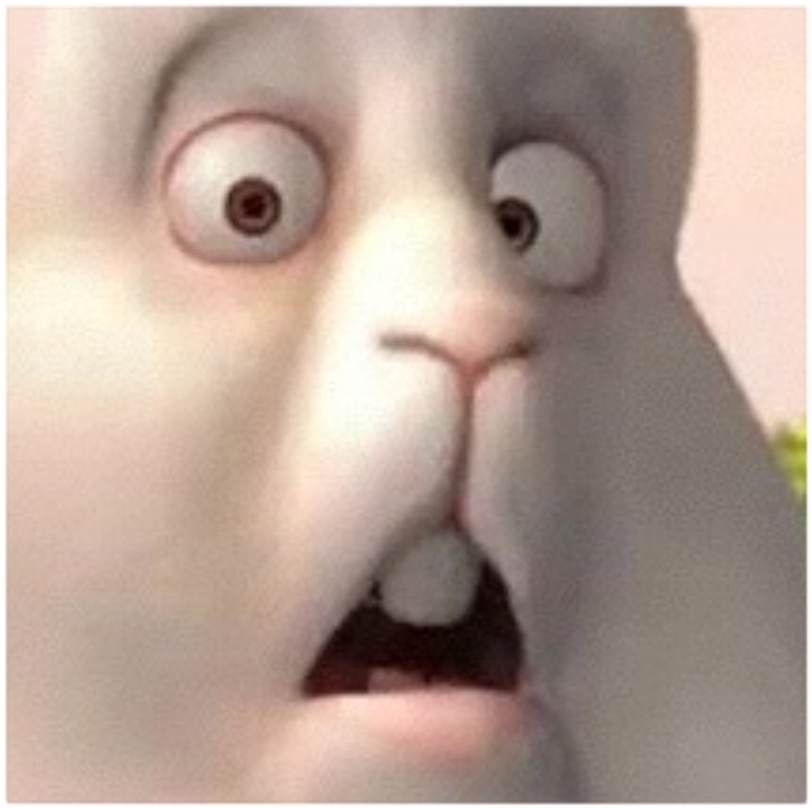
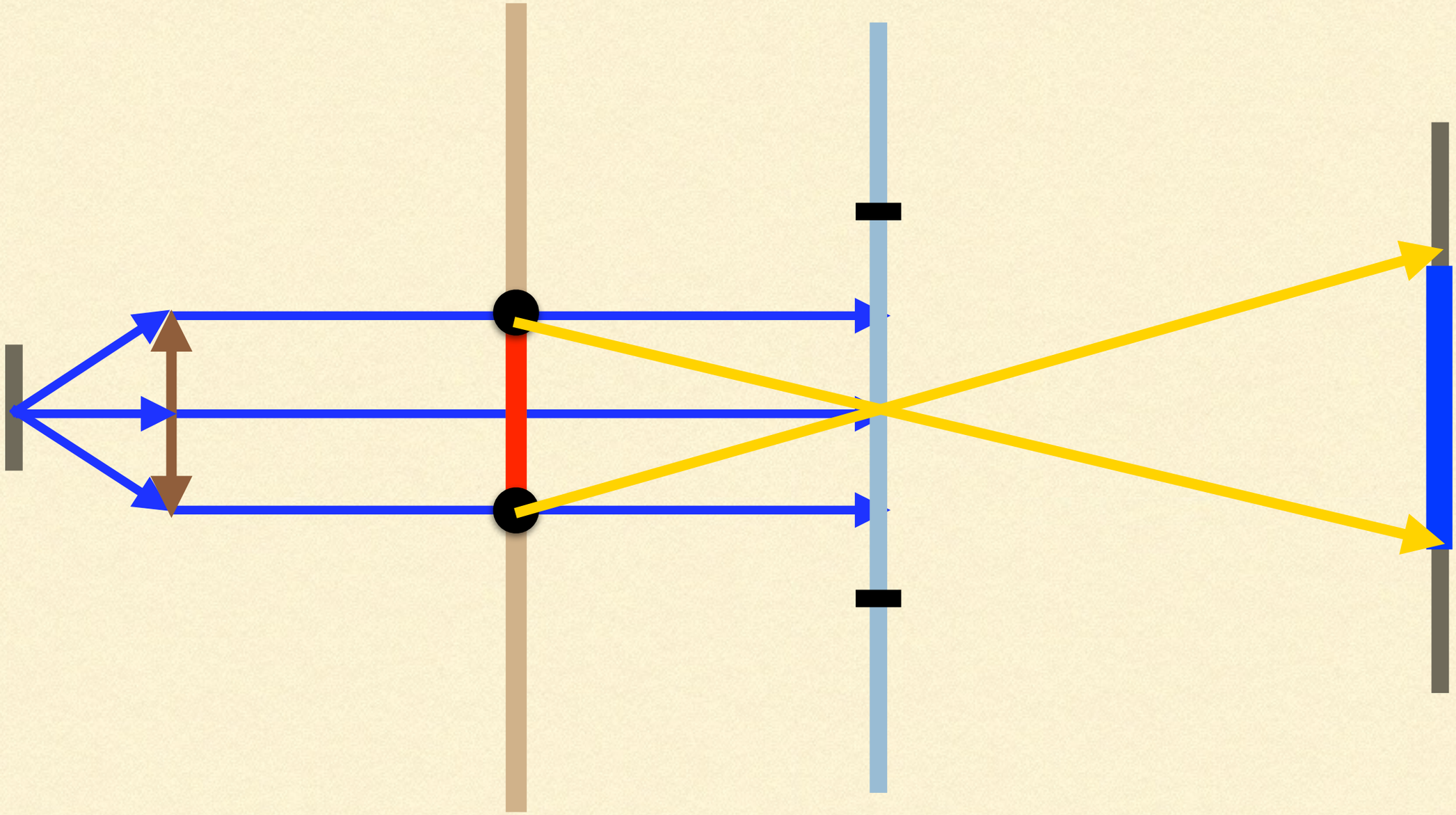


Origin

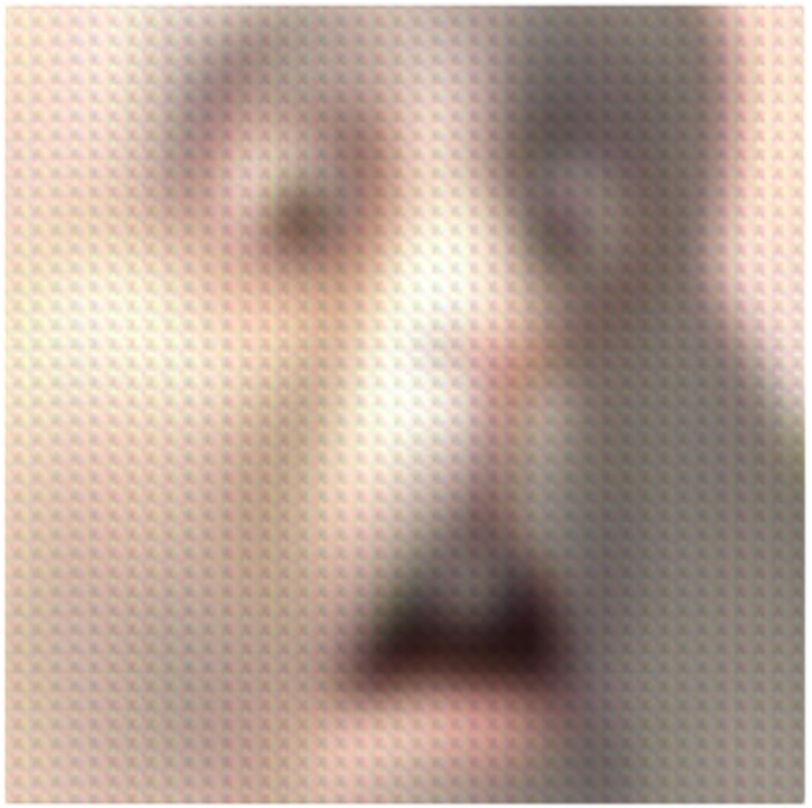
HEADING TO THE FUTURE

LENS ARRAY DISPLAY

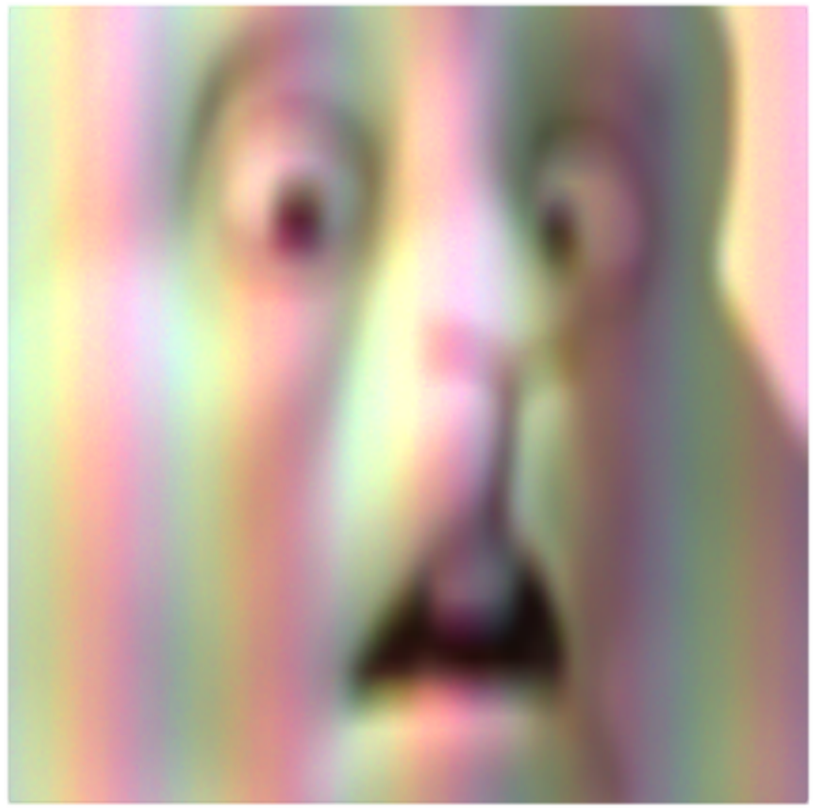


LENS ARRAY DISPLAY

Origin

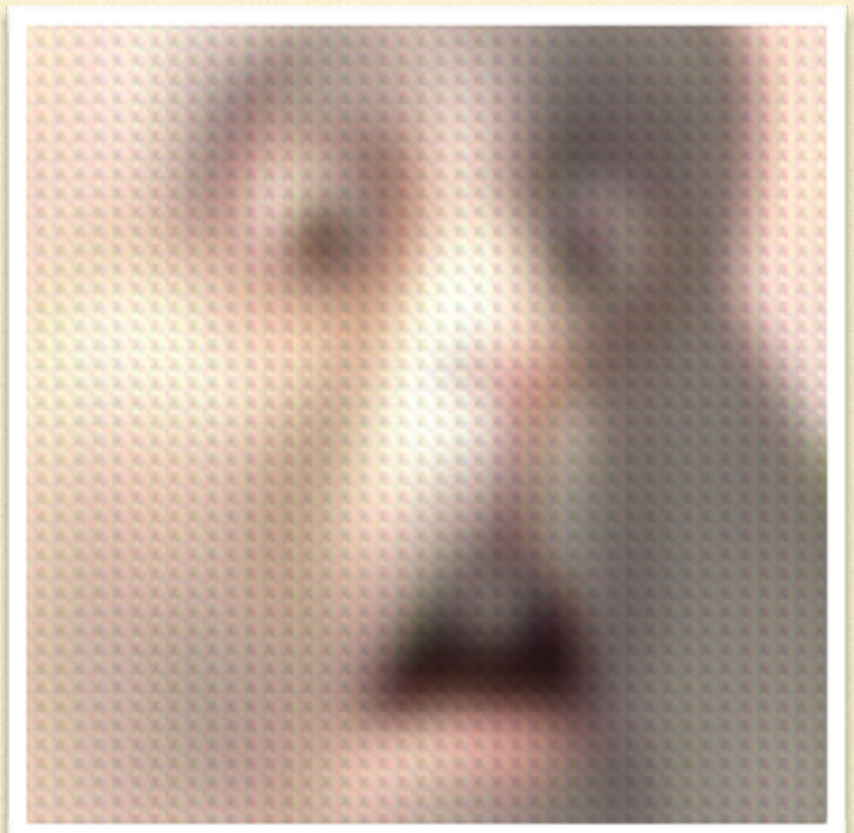


Pinhole Mask



Lens Array

LENS ARRAY DISPLAY



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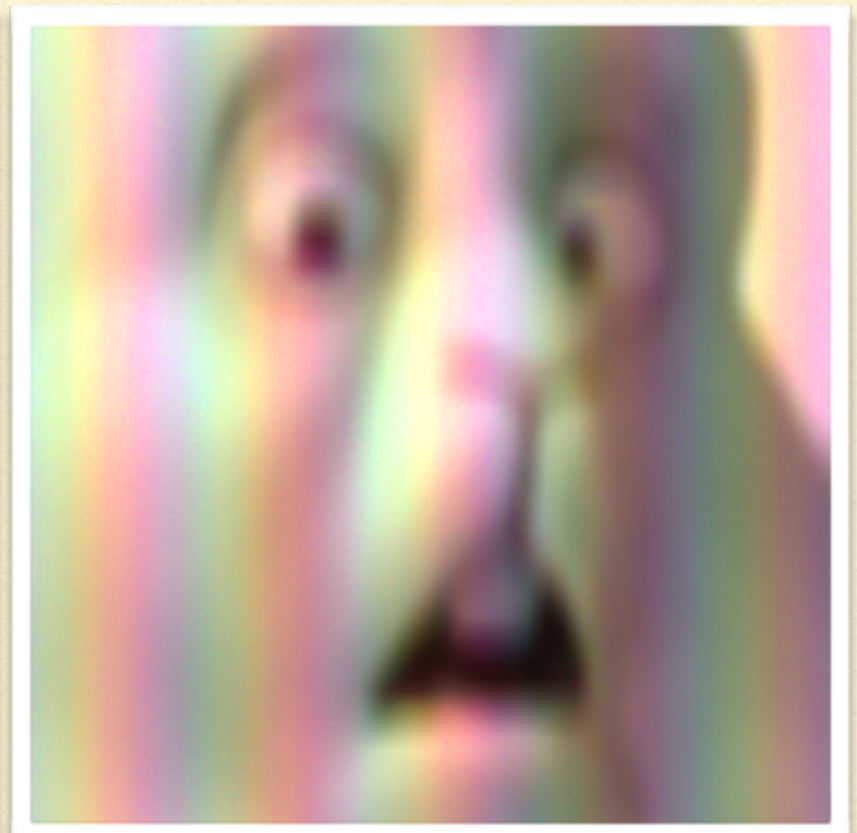

Lens Array

Lens Pinhole

CODE IMPROVEMENTS

- Bug exists. e.g. when resolution changes
- Duplicate Code Segments Exists
- Global Variables

MULTI-THREADING

- The advantages of GPU and clusters (If we have them)
- OpenCL
- MPI

RAY TRACING

- Astigmatism
- Find the correct center
- Take light intensity into consideration

MATHEMATICS

- Give the mathematical expression of the width of blur edge
- Evaluate the performance on different light field displays
- Compute the best depth

IOS PROGRAMMING

- OpenCL or METAL or OpenGL
- Have a practical function. e.g. Video playback

WHERE TO START

- *Thinking in C++*
- *Ray Tracing*
- *Git and Issue Tracing*

ADVANCED TOPICS

- *http://davibu.interfree.it/opencl/smallptgpu/smallptGPU.html*