Multi-perspective Images from Real World Scenes

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Main Reference

M. Agrawala, D. Zorin, T. Munzner:

Artistic Multiprojection Rendering.

In Eurographics Rendering Workshop, 2000.

Artistic Uses of Multiple Projections

- Artistic expression;

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- Artistic expression;
- Representation of the scene.

Artistic expression: viewing anomalies

Title: *The Mystery and Melancholy of a Street*.

Author: Giorgio de Chirico (1888-1978).

Date: 1914.

Medium: Oil on canvas.

Style: Surrealist.

Artistic expression: viewing anomalies

Title: *Still Life with Fruit Basket*.

Author: Paul Cezanne (1839-1906).

Date: 1880-1890.

Medium: Oil on canvas.

Style: French Post-Impressionist.

Reference's Result

Our Result

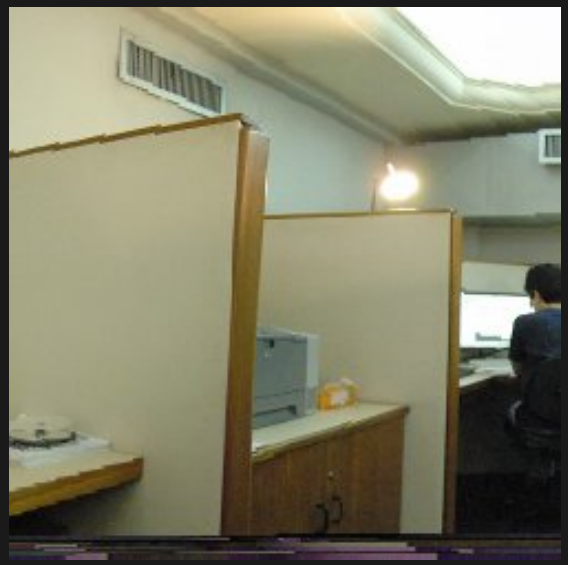
Representation: best views

Title: *Sir John Hawkwood*.

Author: Paolo Uccello (1397-1475).

Date: 1436.

Representation: best views



Our Result

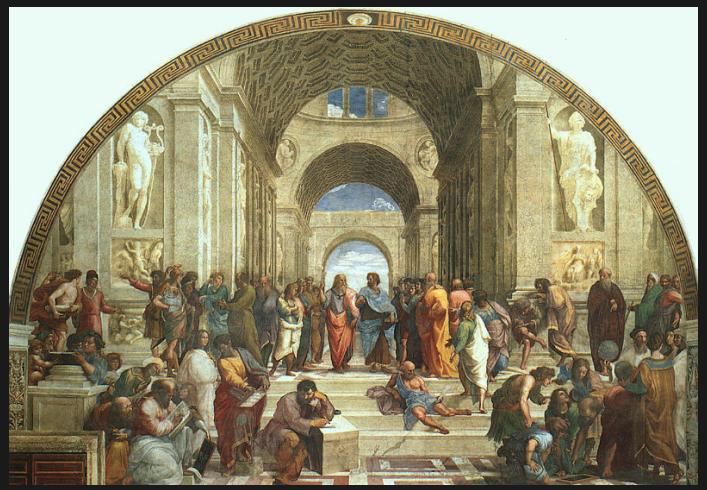
Representation: reducing wide-angle distortions

Title: *School of Athens*.

Author: Raphael Sanzio (1483-1520).

Date: 1510-1511.

Style: Intalian Renaissantist.



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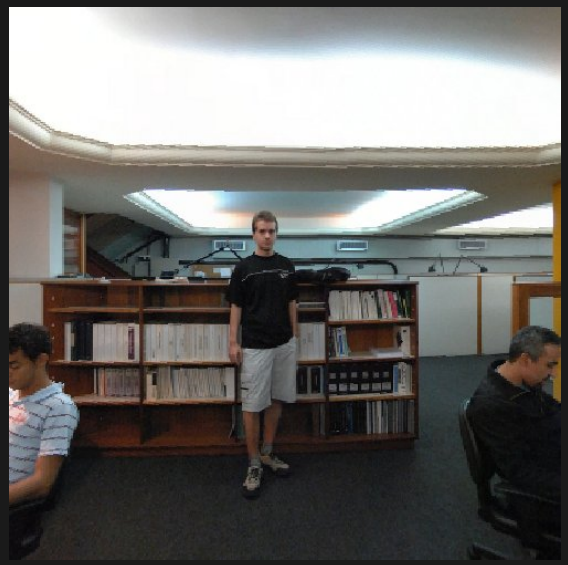

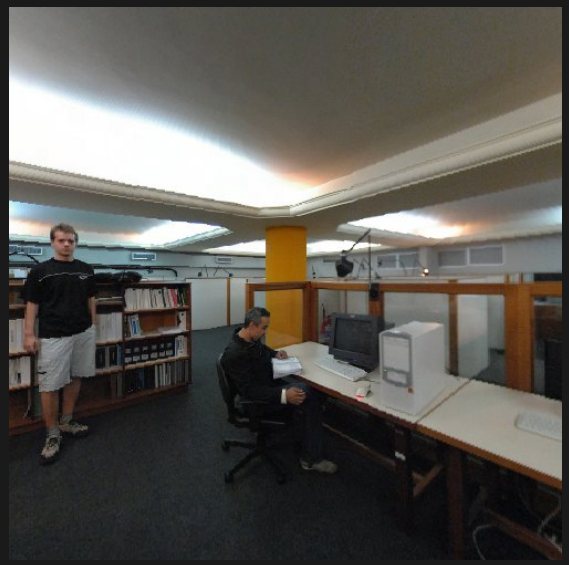

Our Result

Visibility Ordering

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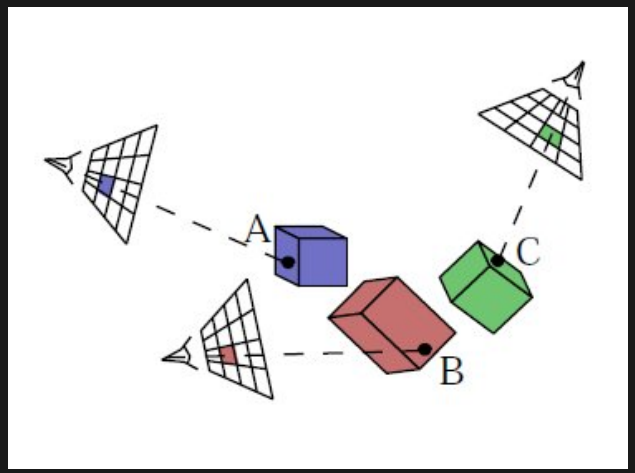
- For multiperspective, however, the set of points that map to a same pixel on the image surface may be a union of straight lines.



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- For all points that would map to a same pixel on the multiperspective final image, we render the one that is closest to the center of projection of a chosen **Master Camera**. This process is called **depth compositing**;

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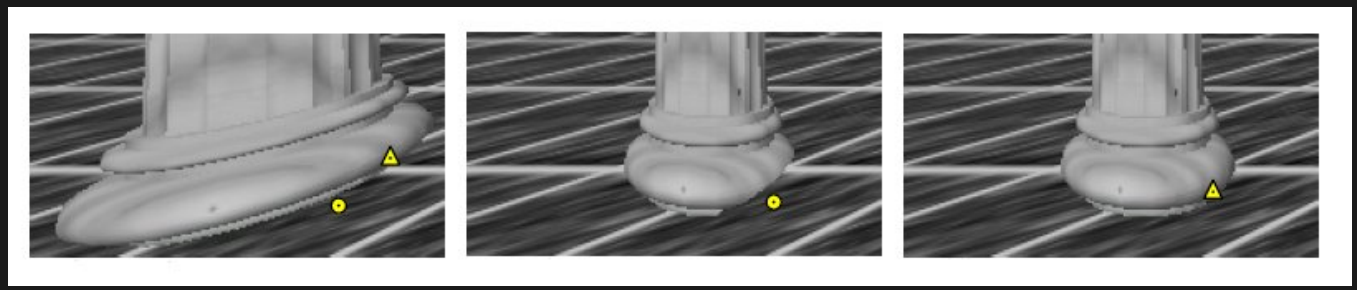
- But problems can occur:



Object-Level Occlusion Constraints

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- There are two possibilities for ambiguities: object A occludes object B in some regions and object B occludes A in other ones; objects A and B do not overlap on the master camera but overlap on the final result;
- The user imposes hard constraints and decides abut the occlusion.

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- If two objects map to the same pixel and there is an occlusion contraint, we use it to solve visibiliy;
- If there are no occlusion constraints, use depth compositing;
- If a cycle occurs (A occludes B, B occludes C and C occludes A), an arbitrary choice of what object will be seen is taken.

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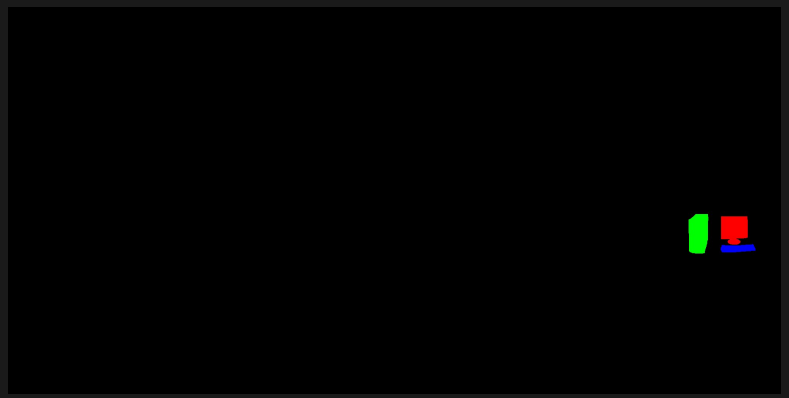
- This sofwtare is based on windows and the interface was built with FLTK (Fast Light Toolkit). The programming languages used were C and C++.
- It is divided in 4 windows and they're ran by a command line script.

Input Data

The user inputs a set of **equirectangular images** from a scene, taken from different points of view. For each image, he gives a corrsepondent image with marked objects and another wich is taken from a close point of view:



Input Data

Window 1 (Step 1)

The first window allows the user to choose

- the look-at vector of each camera;

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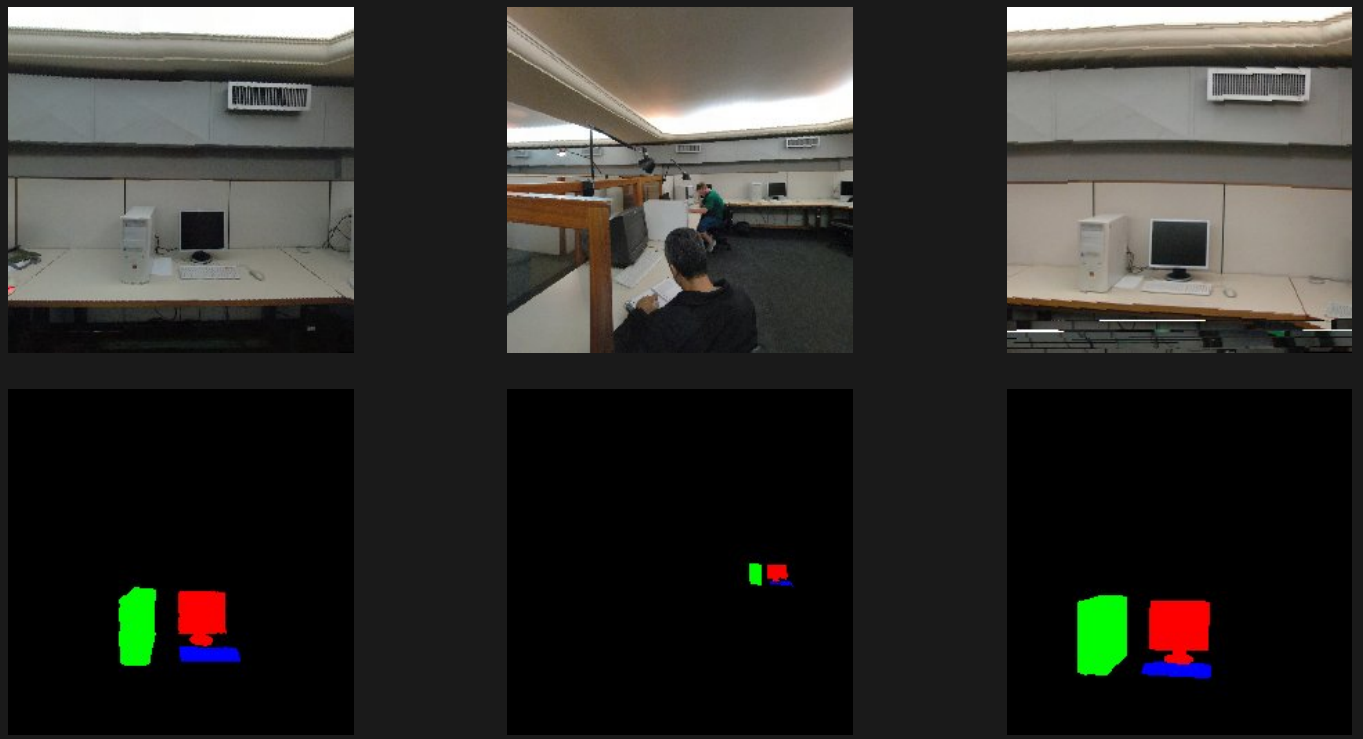
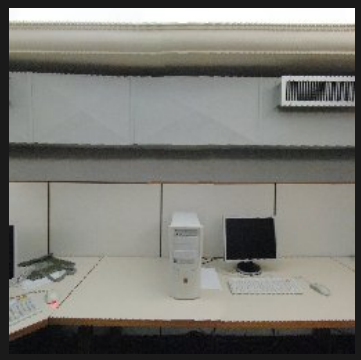
The first window allows the user to choose

- the look-at vector of each camera;
- the zoom of each photograph;
- and which camera will be the master camera;

Results produced by Window 1



Intermediate Step - Computing stereo

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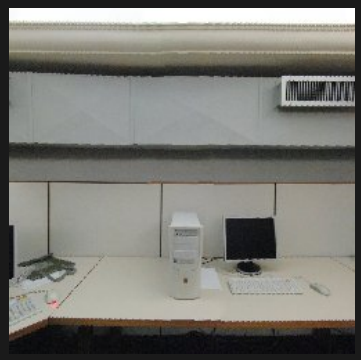
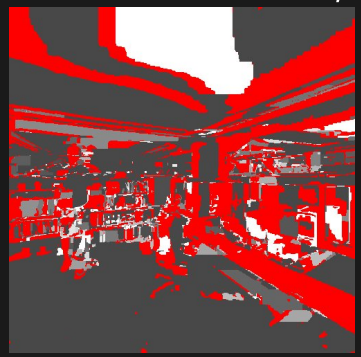
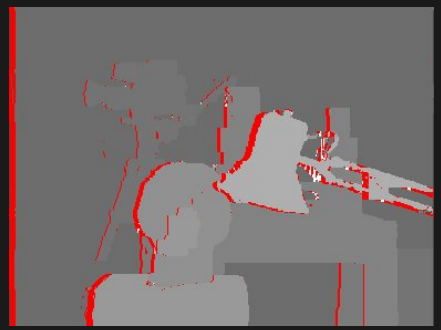


- I decided to use an available algorithm to compute stereo (the pair of images is also output of window 1);
- The information returned by the algorithm would be used for determining depth to the Master Camera;

Intermediate Step - Computing stereo

In most cases, the results are not satisfactory, what lets most of occlucions to the user to determine;

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- If $z_{max}(A) < z_{min}(B)$, set A *occludes* B;
- If $z_{max}(B) < z_{min}(S)$, set B *occludes* A;

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- The user see the Master Camera image and the corresponding objects and chooses the occlusions clicking on buttons;

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- The user see the Master Camera image and the corresponding objects and chooses the occlusions clicking on buttons;
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Window 2 (Step 3) - User occlusion setting

- The user see the Master Camera image and the corresponding objects and chooses the occlusions clicking on buttons;
- Cycles are forced to not happen (if A occludes B and the user sets C to occlude A, then the program set that C occludes A).
- The output of this window is a matrix that represent the occlusion:

$$\begin{pmatrix} 0 & 1 & 1 \\ -1 & 0 & 1 \\ -1 & -1 & 0 \end{pmatrix} \Rightarrow A \text{ occludes } B \text{ and } C \text{ and } B \text{ occludes } C.$$

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- The output of this window is a matrix:

$$\begin{pmatrix} 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \Rightarrow A \text{ from cam } 2 \; B \text{ from } 2 \text{ and } C \text{ from } 3 \; .$$

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- If there is more than one object, use the occlusion constraints and put the color of the object that occludes the others;

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- If there is one object, put the color of this object;
- If there is more than one object, use the occlusion constraints and put the color of the object that occludes the others;
- A window displays the final result;

Post Processing

- The final image has holes caused by taking off objects from the Master Camera and putting nothing on its place.

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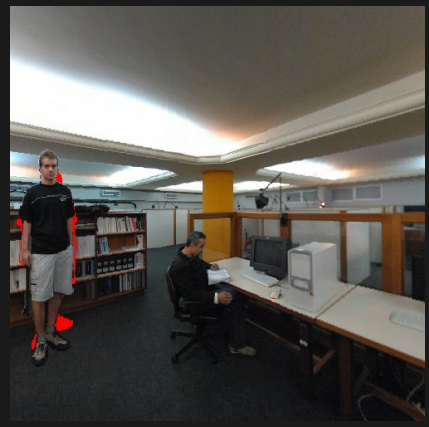
- Inpainting techniques will be usefull for post processing, but I did it manually.

Results






Panoramas

- Use of this program for panoramas: the wider the field of view the greater the need of correcting the perspective for the objects

Intermediate and post processing

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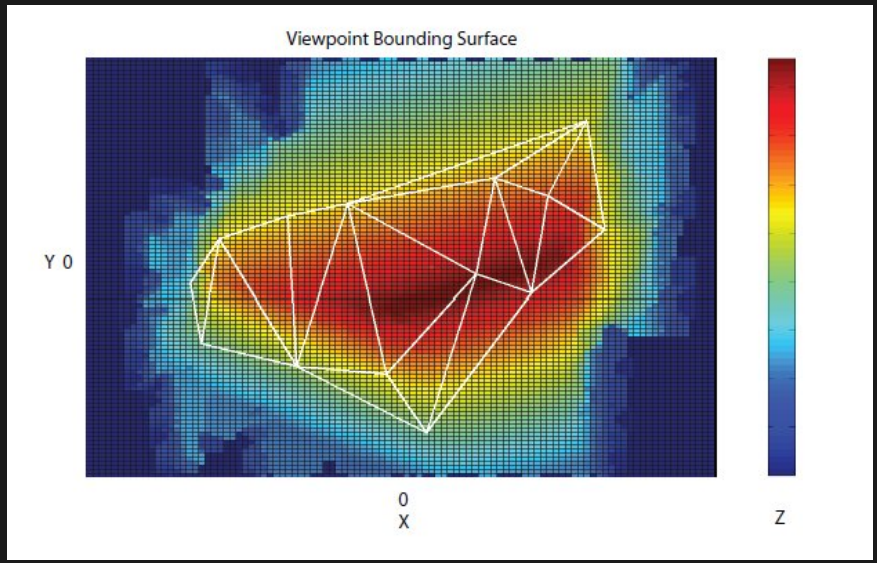
- Find a more efficient way to compute order between objects automatically;
- Inpainting technique for the result;
- Correction of disparities caused by putting different perspectives on the same image;

View Interpolation

Parallax Photography: Creating 3D Cinematic Effects from Stills



Thanks!

Check the website: *http* : //www.impa.br/ ∼ leo-ks/s3d