3D Multimedia System Design Project

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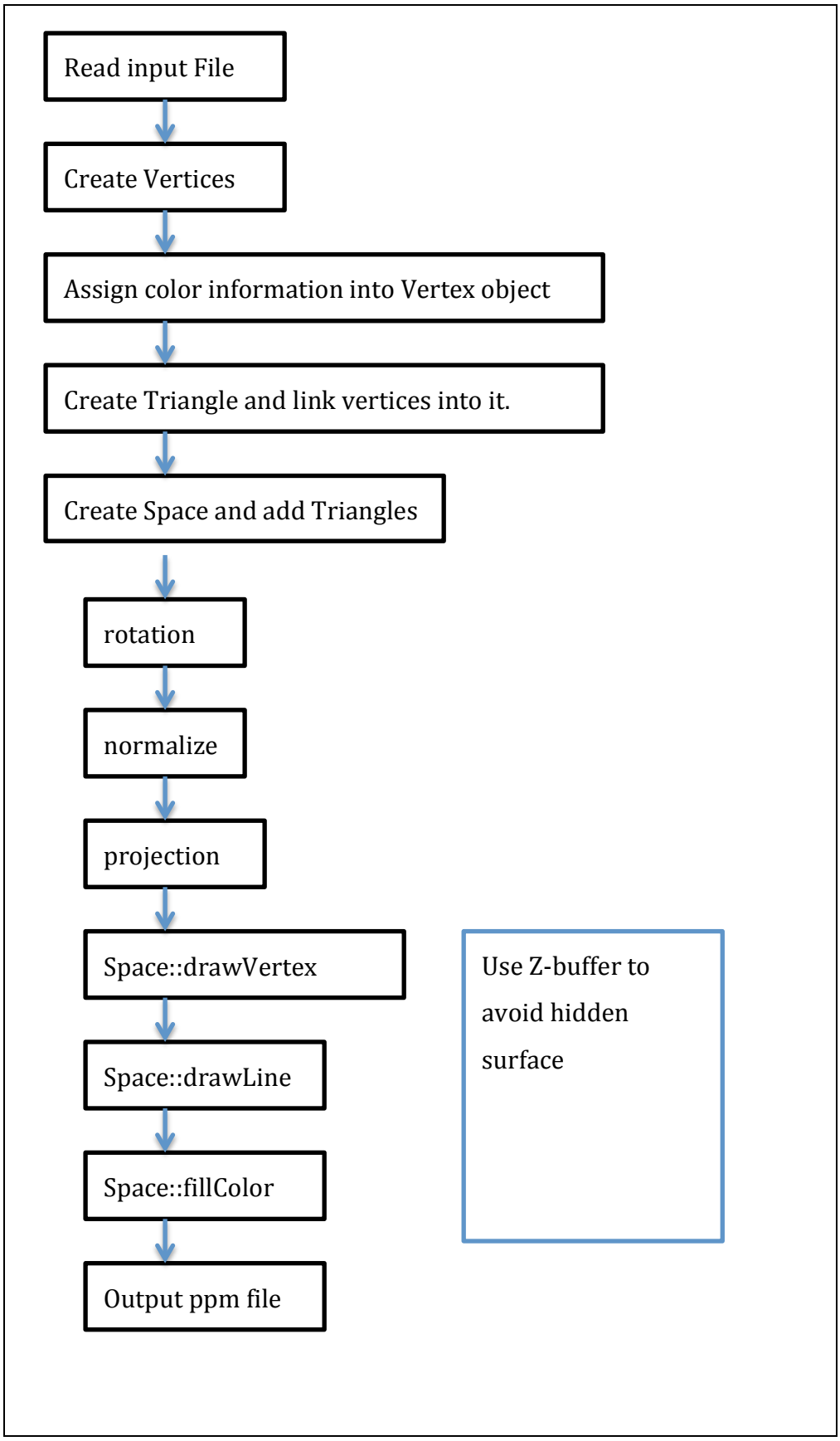
1 Program structure and flow

1.1 Structure

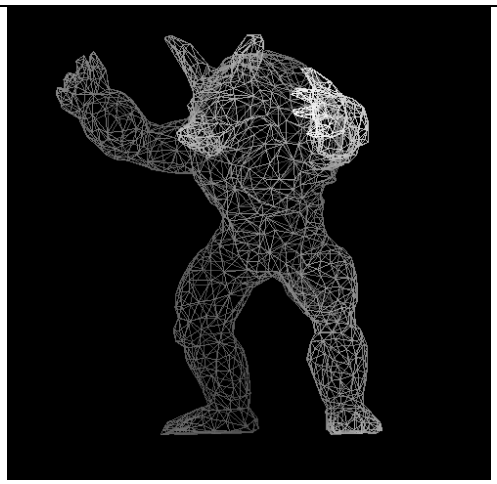
Class name	Function
Main	Program enter point, File I/O (read input file, write a .ppm file)
Vertex	Contains three coordinate values(x, y, z), and one Color data (R, G, B).
Triangle	Containing three Vertex.
Space	Containing a list of Triangles, and some rendering methods, ex: normalize, rotation, rasterization....
ColorImage	It contains a byte array, representing of a 2D image, and another byte array for z-buffer. It can also generate header of .ppm file.
Utils	Some static function, used for some complicated calculations.

1.2 Flow


Read input File
Create Vertices
Assign color information into Vertex object
Create Triangle and link vertices into it.
Create Space and add Triangles
rotation
normalize
projection
Space::drawVertex
Space::drawLine
Space::fillColor
Output ppm file
Use Z-buffer to avoid hidden surface

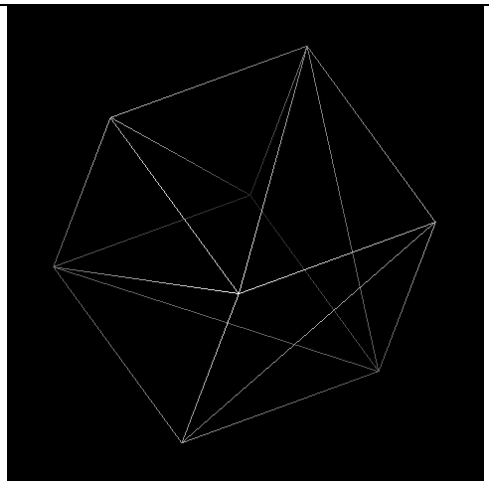
2 Result

2.1 Output image

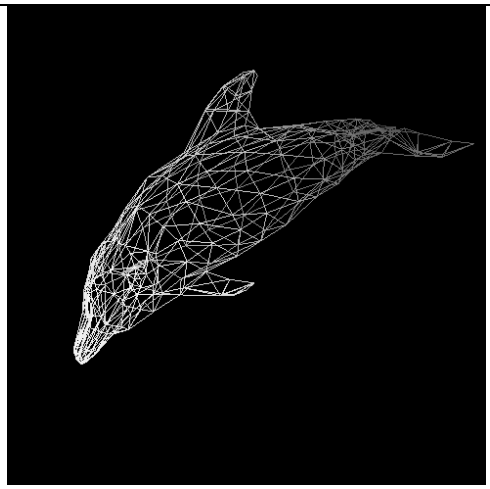


Armadillo3k

bunnyC

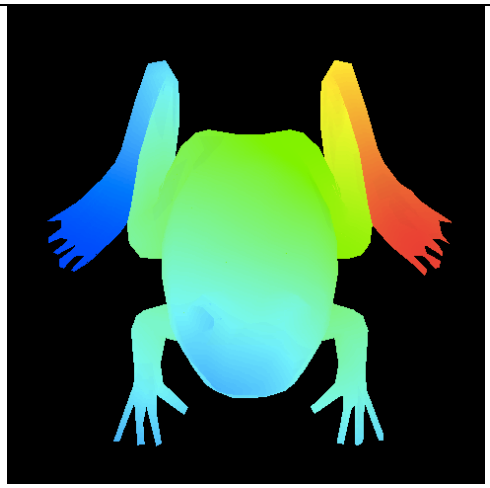


cube

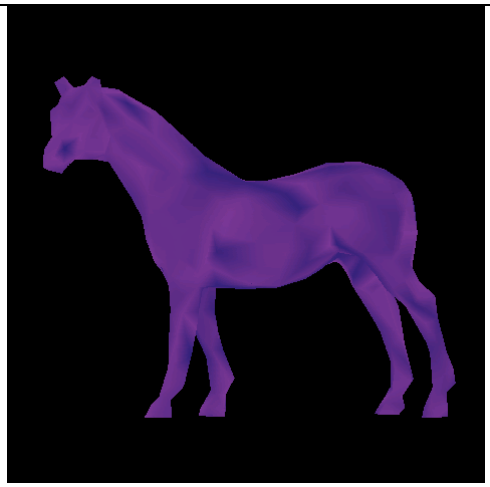
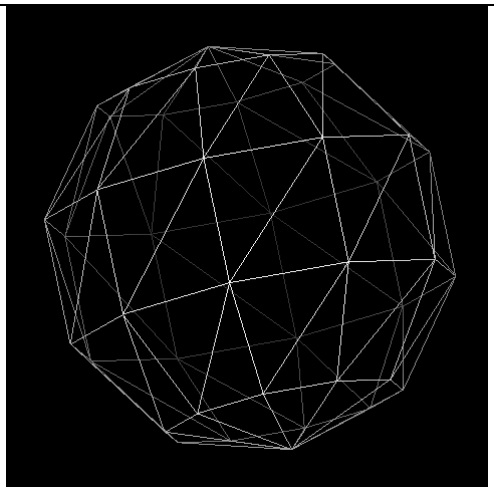
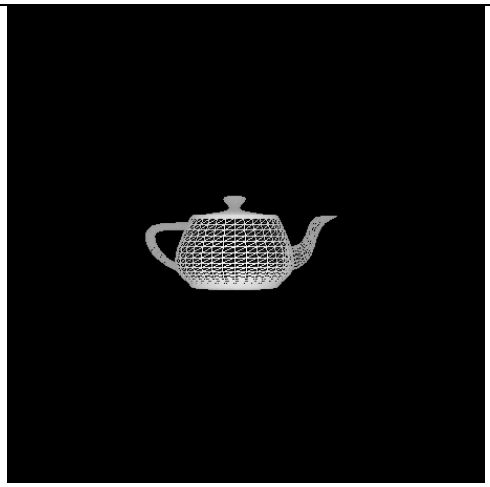
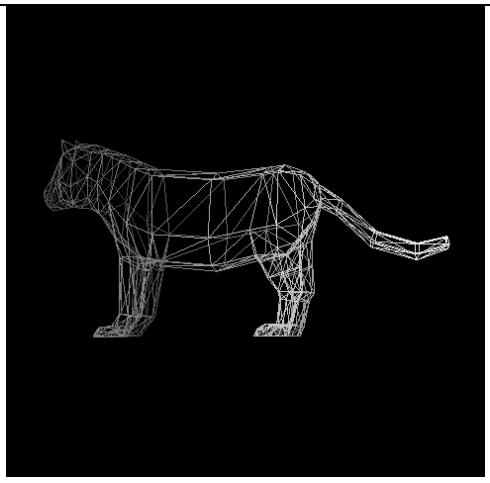
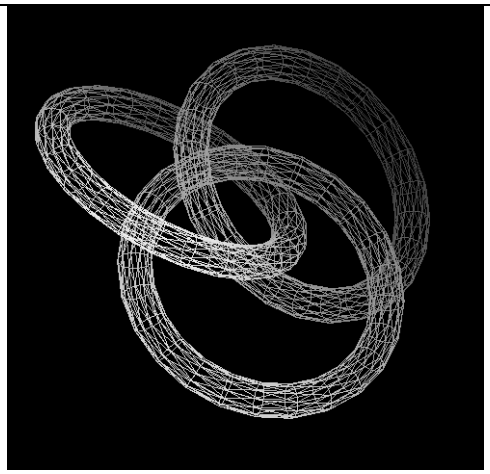


dolphin

dragonC



frog2KC

 Happy5KC	 hourse1KC
 sphere5	 teapot
 tiger	 toruses

原圖為 512X512 pixel. 如果 input file 內沒有 color 資訊, 就只畫出 wire frame.

2.2 Execution time:

File	#Vertex	#triangle	Has color	time
Armadillo3k	1502	3000	No	27ms
bunnyC	1494	2915	Yes	38ms
cube	24	12	No	8ms
dolphin	285	564	No	12ms
dragonC	1257	2730	Yes	36ms
frog2KC	1003	2000	Yes	20ms
Happy5KC	2472	4968	Yes	38ms
hourse1KC	502	1000	Yes	18ms
sphere5	60	100	No	8ms
teapot	2082	4032	No	18ms
tiger	303	602	No	10ms
toruses	864	1728	No	16ms

(時間為同一檔案連續執行 200-1000 次後取平均)

在演算法的設計上，因為我是對每個三角形做操作，所以在 wire frame 的情況下，執行速度應該是和三角型的個數成正比。但是在 color frame 的情況下，速度會受到三角形大小的影響。

另外我們可以從上表看出，cube 和 teapot 的三角形數量差了 300 倍，但是執行時間的差距並沒有想象中的大。表示說大部分的時間都花在 I/O 上了。