SOFT500227: Computer Graphics 2022-Fall

Homework-**2** Solutions

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Honor Code: I promise that I finished the homework solutions on my own without copying other people's work.

第 2 章光栅图形学

2.1 直线算法的实现与分析

DDA 算法

```
// DDA算法中需要大量用到 浮点数运算 和 分支判断，会大大减缓硬件速度
void DDALine(int x0, int y0, int x1, int y1, Color color)
{
        float dx = x1 - x0, dy = y1 - y0;
    float k = dy / dx, y = y0;
    if(k <= 1){
        float y = y0;
        for(int x = x0; x <= x1; x ++){
            draw_pixel(x, (int)(y + 0.5), color);
                y += k;
        }
    }else{
        float x = x0;
        for(int y = y0; y <= y1; y ++){
            draw_pixel(x, (int)(y + 0.5), color);
                x += 1 / k;
        }
    }
}
```

中点画线法

```
// 中点画线法在增量算法的优化下速度大幅提升，
// 且通过优化d0让算法完全在整数运算中实现，大大提高了运算速度
void MidpointLine(int x0, int y0, int x1, int y1, Color color) {
    int a = y0 - y1, b = x1 - x0, x = x0, y = y0;
    int d0 = 2 * a + b, d1 = 2 * a, d2 = 2 * (a + b);
    while(x <= x1) {
        draw_pixel(x, y, color);
        if(d0 < 0){
            x ++, y ++, d += d2;  //右上方
        }else{
            x ++, d += d1;        //右方
        }
    }
}
```

Bresenham 算法

```
// 比起中点画线法，Bresenham算法的推导过程简单易理解；
// 且由于判断都是定性，同样可以通过优化初值让算法完全由整数运算构成
void BresenhamLine(int x0, int y0, int x1, int y1, int color){
    int dx = x1 - x0, dy = y1 - y0, x = x0, y = y0;
    int e = -dx;
    for(int i = 0; i <= dx; i++){
        draw_pixel(x, y, color);
        x ++, e += 2 * dy;
        if(e >= 0){
            y ++, e -= 2 * dx;
        }
    }
}
```

2.2 中点画圆法

```
// sym_draw(int x, int y, Color color)函数依照八分对称性画出(x,y)的对称点
void sym_draw(int x, int y, Color color) {
        draw_pixel(x, y, color);
        draw_pixel(y, x, color);
        draw_pixel(-x, y, color);
        draw_pixel(-y, x, color);
        draw_pixel(x, -y, color);
        draw_pixel(y, -x, color);
        draw_pixel(-x, -y, color);
        draw_pixel(-y, -x, color);
}

void MidPointCircle(int r, Color color){
    int x, y, d;
    int x = 0, y = r, e = 1 - r;
    sym_draw(x, y, color);
    while (x <= y) {                        // 到直线x=y结束
        if(e < 0) e += 2 * x + 3;           // 右侧
        else e += 2 * (x - y) + 5, y--;     // 右下
        sym_draw(x ++, y, color);
    }
}
```

Other things

LaTeX code refer to these things and was complied on texlive2020.

- UCB-CS70's given homework template.
- A free website useful to edit LaTeX formula code.

The purpose of writing in English is to adapt to bilingual teaching and to improve my poor English writing skills in preparation for a possible future exchange program.

Thanks for your correcting and grading :).