디지털 영상처리 연구실 연구보고서

김우헌

##모폴로지 연산

```
pDoc->m_AllocStructureElementBinary(6);
pDoc->m_SetStructureElementBinary(0, 6, 0);
pDoc->m_SetStructureElementBinary(1, 0, -1);
pDoc->m_SetStructureElementBinary(2, 0, 0);
pDoc->m_SetStructureElementBinary(3, 0, 1);
pDoc->m_SetStructureElementBinary(4, -1, 0);
pDoc->m_SetStructureElementBinary(5, 1, 0);

pDoc->m_MorphologyBinaryDilation(256, 256);

pDoc->m_FreeStructureElementBinary();

pDoc->m_AllocStructureElementBinary(10);
pDoc->m_SetStructureElementBinary(0, 10, 0);
pDoc->m_SetStructureElementBinary(1, -1, -1);
pDoc->m_SetStructureElementBinary(2, 0, 0);
pDoc->m_SetStructureElementBinary(3, -1, 0);
pDoc->m_SetStructureElementBinary(4, -1, 1);
pDoc->m_SetStructureElementBinary(5, 0, -1);
pDoc->m_SetStructureElementBinary(6, 1, -1);
pDoc->m_SetStructureElementBinary(7, 1, 1);
pDoc->m_SetStructureElementBinary(8, 1, 0);
pDoc->m_SetStructureElementBinary(9, 0, 1);


 pDoc->m_MorphologyBinaryErosion(256, 256);


pDoc->m_FreeStructureElementBinary();
```

	1	
1	1	1
	1	

팽창연산을 위한 마스크

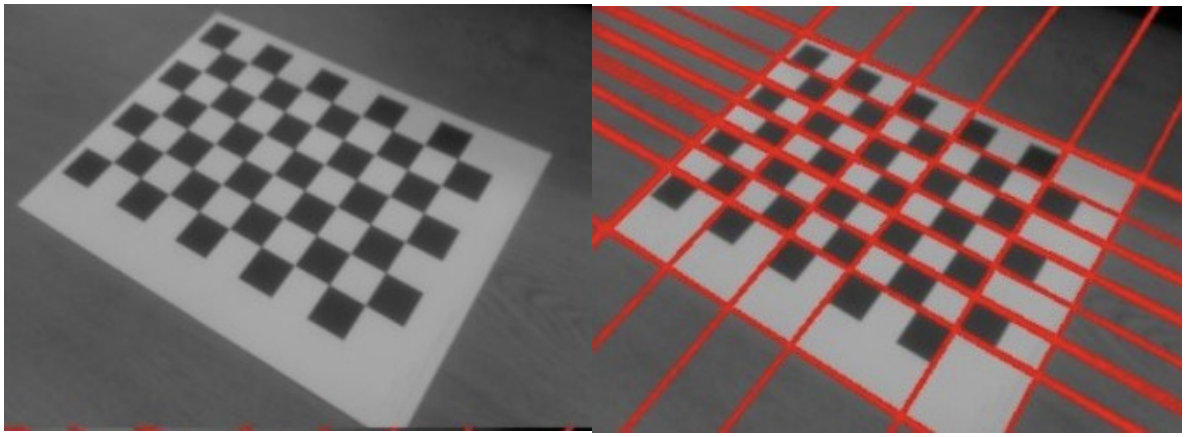
1	1	1
1	1	1
1	1	1

침식연산을 위한 마스크

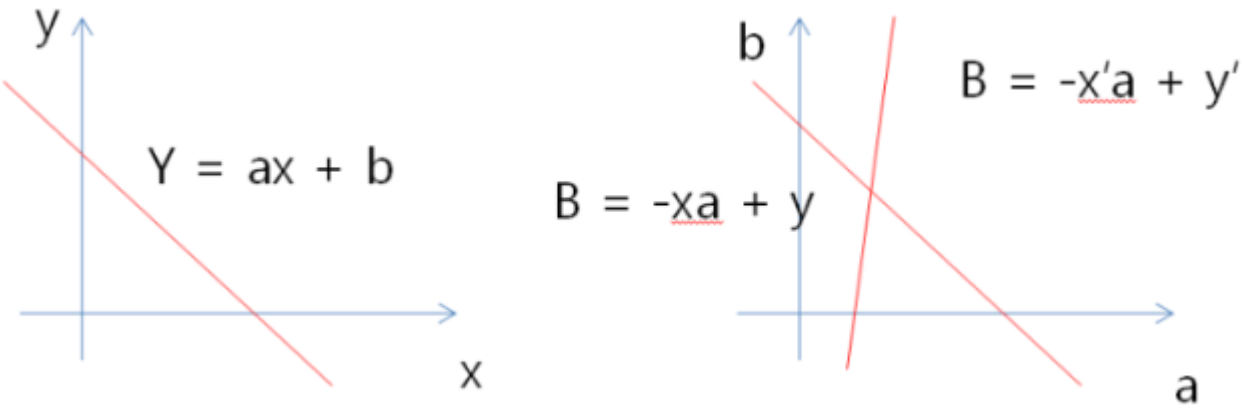
->팽창 ->침식

##허프변환

➔ edge들을 그룹화



#직선추출 허프변환 원리

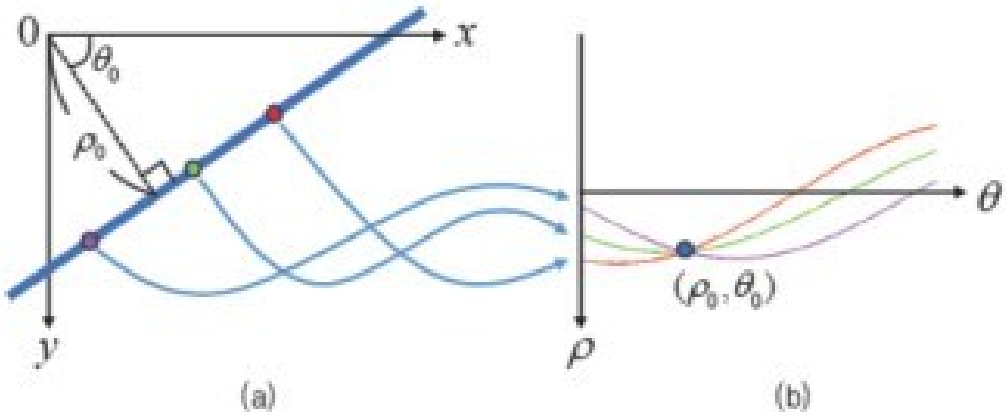


->문제점발생

->y=c와 같은 직선들은 파라메타 공간으로 표현불가

---➔ 삼각함수를 이용한 직선 방정식 이용

$$x\cos\theta_0 + y\sin\theta_0 = \rho_0$$



->이때 x-y 평면에서의 범위는 0<p0<d, 0<θ<180 입니다.

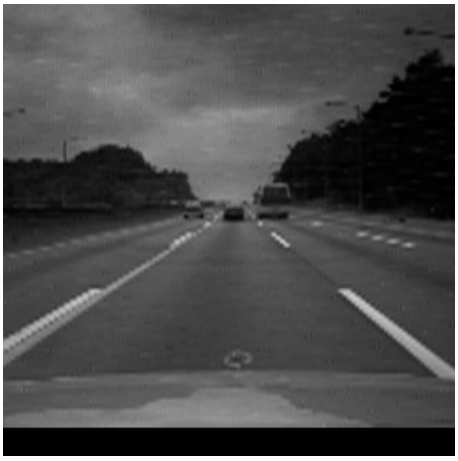
#HT 코드구현

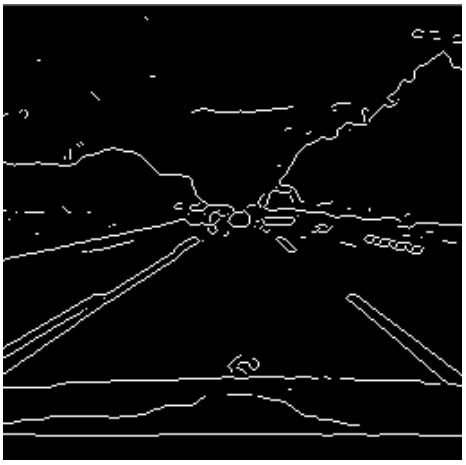
```
        for (i = 0; i < height; i++)
        {
                index = i * width;
                for (j = 0; j < width; j++)
                {
                        if (orgImg[index + j] == 255)
                        {
                                for (k = 0; k < 360; k++)
                                {
                                        d = (int)(j * LUT_COS[k] + i * LUT_SIN[k]);
                                        if (d >= 4 && d <= 360) H[k][d]++;              //H[360][362]
                                }
                        }
                }
        }
```

-> H[k][d] 로 카운팅 =파라메타 공간에서의 보팅과정

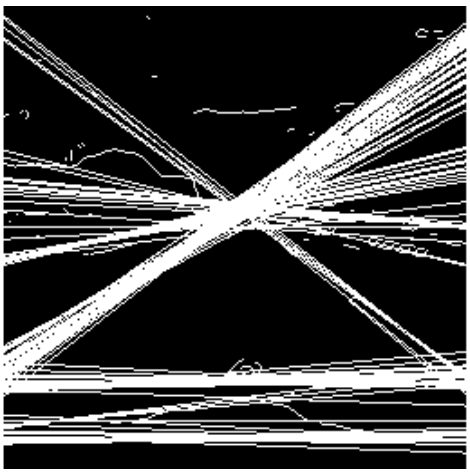
```
for (d = 4; d <= 360; d++)
        {
                for (k = 0; k < 360; k++)
                {
                        if (H[k][d] > thres)
                        {
                                for (j = 0; j < width; j++) |
                                {
                                        i = (int)((d - j * LUT_COS[k]) / LUT_SIN[k]);
                                        if (i < height && i>0) outImg[i * width + j] = 255;
                                }

                        }
                }
        }
```

➔ 파라메타공간 H[k][d] > thres 인 부분에서 k,d값을 이용하여 image의 x,y좌표를 구하여 직선 그리는 과정





-> ORGNAL IMAGE



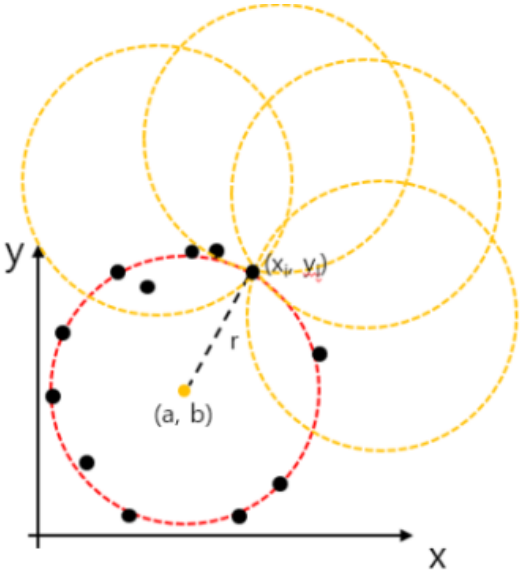
-> thres=30

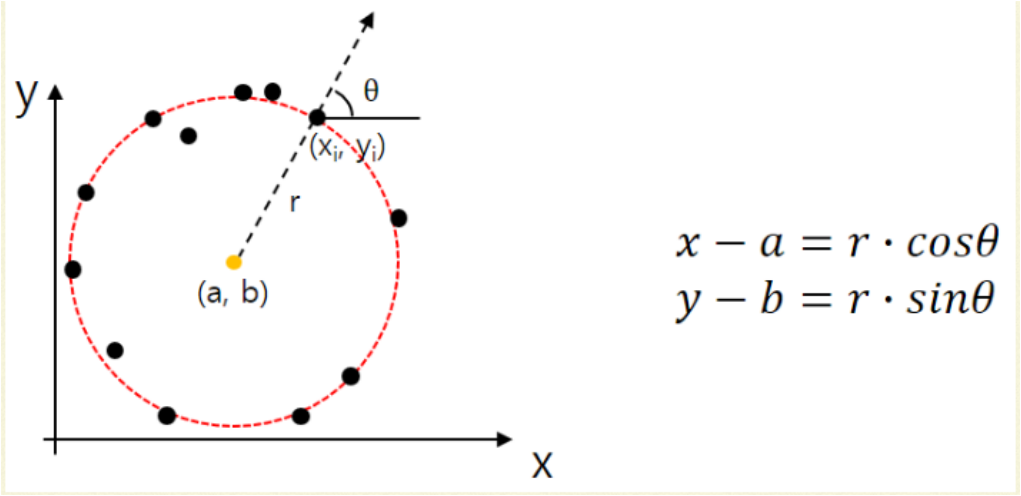
-> thres=60

-> thres=70

#원추출 허프 변환

->직선과는 달리 3개의 파라메터 존재(중심좌표cx,cy와 반지름r)->보팅을 위한 허프공간=3차원





$$x - a = r \cdot cos\theta$$
$$y - b = r \cdot sin\theta$$

#HT 원추출 코드 구현

```
if (orgImg[index + j] == 255)
   {
      for (k = r_min; k < r_max; k++)
           {
              for (ang = 0; ang < 360; ang++)
                {
                    rr = (int)(i - k * LUT_COS[ang]);
                    cc = (int)(j - k * LUT_SIN[ang]);
                    if (rr < height && rr>0 && cc < width && cc>0) H[rr][cc][k]++;
                }
           }
   }
```

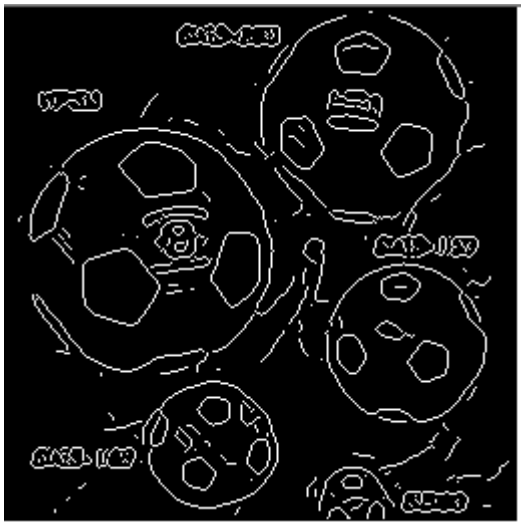
➔ i,j값으로 rr,cc(원중심),k값(반지름) 파라메타 공간에서의 보팅

➔ rmin,rmax를 설정하여 계산시간 단축

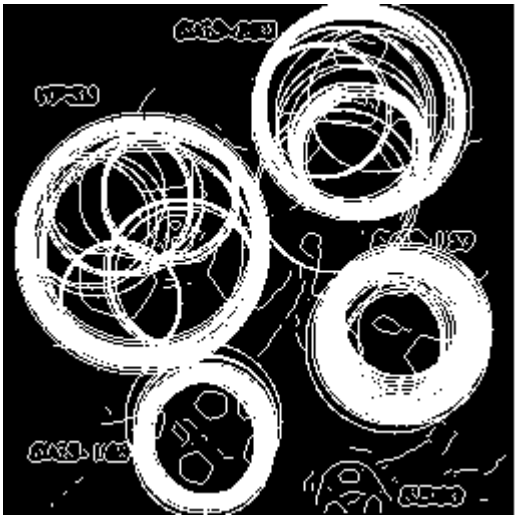
```
for (rr = 0; rr < height; rr++)
  {
      for (cc = 0; cc < width; cc++)
        {
              for (k = r_min; k < r_max; k++)
                {
                    if (H[rr][cc][k] > thres)
                        {
                            for (ang = 0; ang < 360; ang++)
                              {
                                  i = (int)(rr + k * LUT_COS[ang]);
                                  j = (int)(cc + k * LUT_SIN[ang]);
                                 if (i > 0 && i < height && j>0 && j < width) outImg[i * width + j] = 255;
                              }
                        }
                }
        }
  }
```

➔ 파라메터 3차원공간에서 H[rr][cc][k] 값이 thres보다 클 경우에 추출하려는 대상으로 인식->디스플레잉

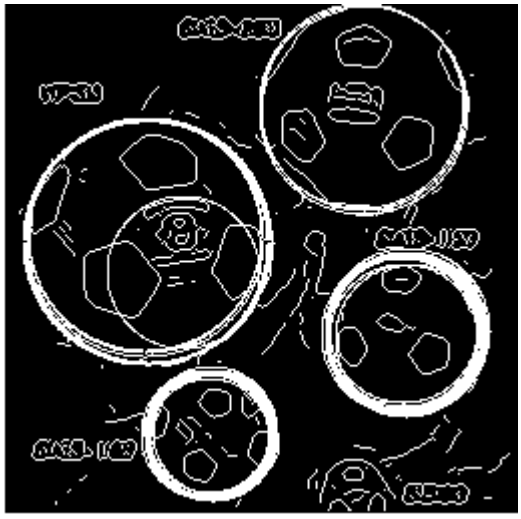
#원추출 결과



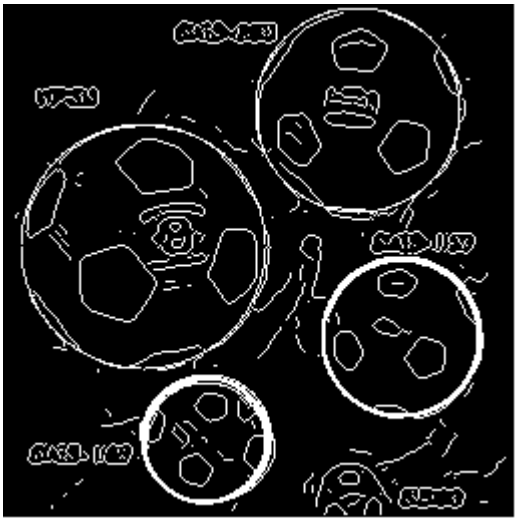
ORG NAL IMAGE



-> THRES=70



-> THRES=90

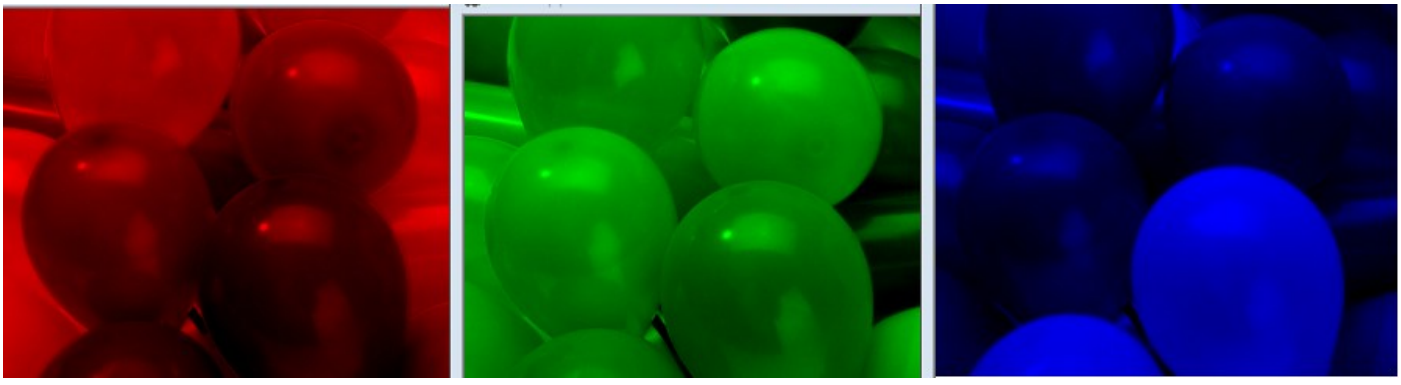


-> THRES=110

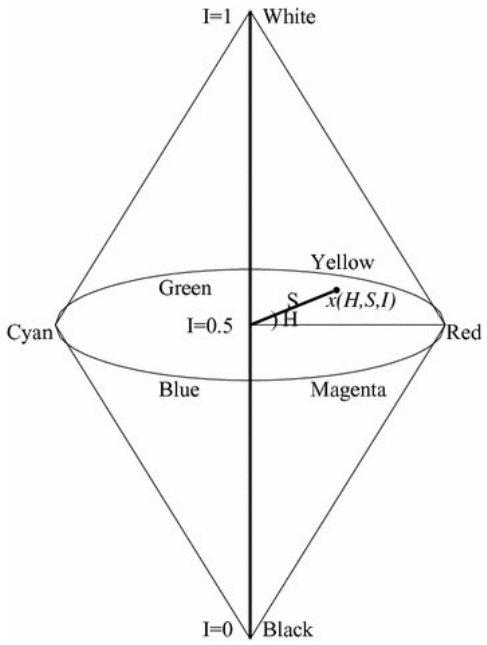
##컬러영상처리

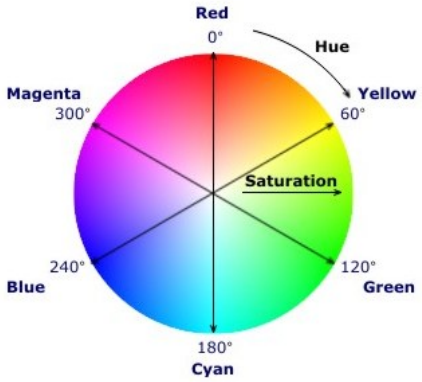
#RGB 모델

```
int index, i, j;
    for (int k = 2; k >= 0; k++)
      {
         for (i = 0; i < height * rwsize; i++) pDoc->m_Outlmg[i] = 0;
          for (i = 0; i < height; i++)
            {
                 index = (height - i - 1) * rwsize;
                   for (j = 0; j < width; j++)
                       pDoc->m_Outlmg[index + 3 * j + k] = pDoc->m_Inlmg[index + 3 * j + k];
            }
       pDoc->CopyClipboard(pDoc->m_Outlmg, height, width, 24);
```



#HSI 색 모델





- H(색상)-> 0~360도
- S(채도)->순색에 첨가된 백색광의 비율->0~1사이(클수록 포화=순색)
- I(명도)->빛의세기 ->0~1사이

```
for (i = 0; i < height; i++)
       {
          index = (height - i-1) * rwsize;
              for (j = 0; j < width; j++)
                {
                   r = (float)InImg[index + 3 * j + 2] / 255.0f;
                   g = (float)InImg[index + 3 * j + 1] / 255.0f;
                   b = (float)InImg[index + 3 * j] / 255.0f;

                    min =( (r) < (g) ? (r) : (g));
                    min =( (min) < (b) ? (min) : (b));    ///RGB중 최솟값찾음

                    iv = (r + g + b) / 3.0f;              //밝기구함

                    s = 1.0f - (3.0f / (r + g + b)) * minc;  //채도 구함
                    angle = (r - 0.5f * g - 0.5f * b) / (float)sqrt((r - g) * (r - g) + (r - b) * (g - b));
                    h = (float)acos(angle);          //색상구함
                    h *= 57.29577951f;
                }

                      if (b > g)       h = 360.0f - h;
                      ih = (int)(h * 255.0 / 360.0);
                      OutImg[index + 3 * j] = (unsigned char)ih;
                      OutImg[index + 3 * j + 1] = (unsigned char)(s * 255.0);
                      OutImg[index + 3 * j + 2] = (unsigned char)(iv * 255.0);
                }
       }
```

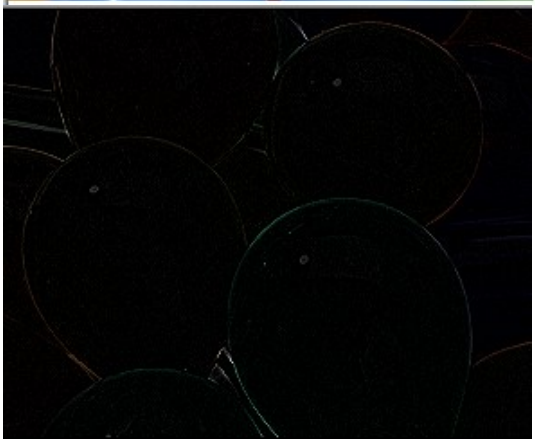
H S I

#컬러이미지의 라플라시안

->컬러이미지의 라플라시안 마스크는 RGB컬러->HSI컬러로 바꾼 후
-> I (밝기)에 대해 라플라시안 연산을 진행한후에
-> 밝기 연산 결과값과 기존의 H,S를 이용하여 다시 RGB컬러로 바꾼 후
-> 디스플레이 하여 줍니다.

```
for (i = n; i < height - n; i++)   //n=1
        {
                index1 = i * width;
                for (j = n; j < width - n; j++)
                {
                        sum = 0.0f;


                    for (k = -n; k <= n; k++)
                       {
                          index2 = (i + k) * width;
                          index3 = (k + n) * winsize;
                            for (l = -n; l <= n; l++)
                              sum += InImg[index2 + (j + l)] * Mask[index3 + l + n]; //마스크컨볼루션연산
                       }
                       CLIP(sum, 0, 255);
                       OutImg[index1 + j] = (unsigned char)sum;
                }
        }
```

0	-1	0
-1	4	-1
0	-1	0

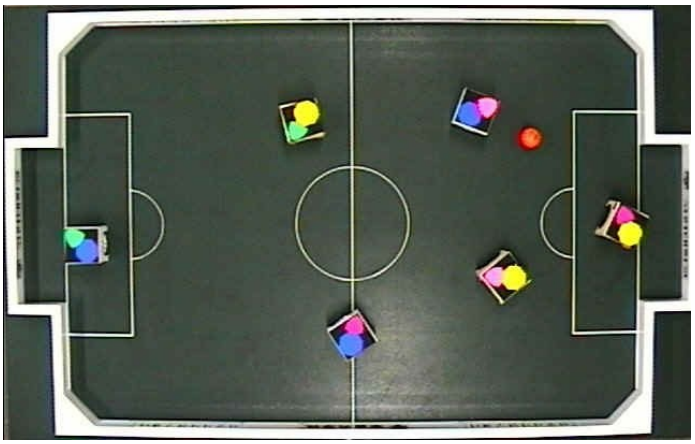


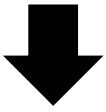
#컬러이미지의 이진화

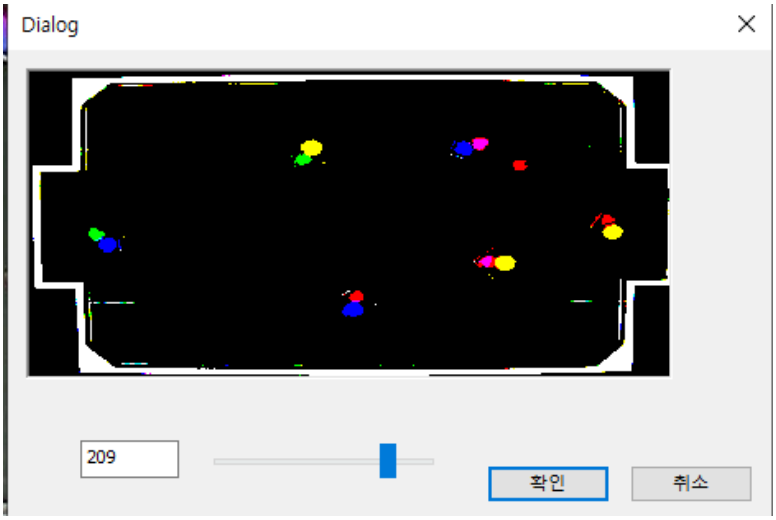
➔ 그레이 이미지의 이진화와 비슷한 방법으로 컬러 이미지도 이진화가 가능합니다.

```
for (i = 0; i < 256; i++) LUT[i] = i > m_ThresValueDisp ? (unsigned char)255 : 0;
for (i = 0; i < height; i++)
                {
                        index = (height - i - 1) * rwsize;
                        for (j = 0; j < width; j++)
                        {
                                index2 = index + 3 * j;
                                m_TmpImg[index2] = LUT[(int)(pDoc->m_OutImg[index2])];
                                m_TmpImg[index2 + 1] = LUT[(int)(pDoc->m_OutImg[index2 + 1])];
                                m_TmpImg[index2 + 2] = LUT[(int)(pDoc->m_OutImg[index2 + 2])];
                        }
                }
```

➔ 동적으로 변하는 m_ThresValueDisp 값에따라 rgb채널별로 이진화 진행







#컬러 히스토그램 정합

-정합의 원리

$$\emptyset = \frac{\sum \min(I, M)}{\sum I}$$

➔ ø는 원래의 이미지I의 히스토그램과 모델 히스토그램 M의 관계로 구할 수 있습니다.

->컬러 이미지의 히스토그램은 256*256*256 의 방대한 계산이 필요한데 SWAIN의 히스토그램으로 8x8x4의 bin을 가진 컬러이미지 히스토그램을 이용하여 정합을 실시합니다.

```
for(k=0; k<8; k++)
                {
                        for(l=0; l<8; l++)
                        {
                                for(m=0; m<4; m++)
                                {
                                        sumTest += vote[k][l][m];
                                        if(m_vote[k][l][m]<vote[k][l][m]) minVal = m_vote[k][l][m];
                                else     minVal = vote[k][l][m];

                                        sumComp += minVal;
                                }
                        }
                }

                matchVal = (float)sumComp / sumTest;

                if(matchVal>=currVal)
                {
                        currVal = matchVal;
                        currRow = i;
                        currCol = j;
                }
```