# Computer Vision HW7

R10922A16 蔡家豪

**Homework 7**

Thinning

Step1:

Yokoi like HW6

Code:

```
char h( int x0 ,int x1 , int x2 , int x3){
    if(x0 == x1){
        if(x0 == x2 && x0 == x3) return 'r';
        else return 'q';
    }
    return 's';
}
int f( char b ,char c ,char d ,char e ){
    if(b == 'r' && c == 'r' && d == 'r' && e == 'r') return 5;
    int cnt = 0;
    if(b == 'q') cnt++;
    if(c == 'q') cnt++;
    if(d == 'q') cnt++;
    if(e == 'q') cnt++;

    return cnt;
}
```

```
///yokoi
    char b,c,d,e;
    for(int i=1 ; i < 65 ; i++){
        for(int j = 1 ; j < 65 ; j++){
            if( down[i][j] == 1 ){
                b = h( down[i][j] , down[i][j+1] , down[i-1][j+1] , down[i-1][j] );
                c = h( down[i][j] , down[i-1][j] , down[i-1][j-1] , down[i][j-1] );
                d = h( down[i][j] , down[i][j-1] , down[i+1][j-1] , down[i+1][j] );
                e = h( down[i][j] , down[i+1][j] , down[i+1][j+1] , down[i][j+1] );
                ans[i-1][j-1] = f( b , c , d , e );
            }
        }
    }
```

Step2: Pair Relation Operator & Connected Shrink Operator

Code:

```
void PRO(vector<vector<int>> &ans){
    int table[66][66];
    for(int i = 0 ; i < 66 ; i++){
        for(int j = 0 ; j < 66 ; j++){
            table[i][j] = 0;
        }
    }
    for(int i = 1 ; i < 65 ; i++){
        for(int j = 1 ; j < 65 ; j++){
            table[i][j] = ans[i-1][j-1];
        }
    }

    for(int i = 1 ; i < 65 ; i++){
        for(int j = 1 ; j < 65 ; j++){
            if(table[i][j] == 0) ans[i-1][j-1] = 0;
            else if(table[i][j] == 1){
                if(table[i+1][j] == 1 || table[i-1][j] == 1 || table[i][j+1] == 1 || table[i][j-1] == 1)
                    ans[i-1][j-1] = 1;
                else ans[i-1][j-1] = 2;
            }
            else ans[i-1][j-1] = 2;
        }
    }
    return ;
}
```

```
void CSO(vector<vector<int>> &ans){
    int table[66][66];
    for(int i = 0 ; i < 66 ; i++){
        for(int j = 0 ; j < 66 ; j++){
            table[i][j] = 0;
        }
    }
    for(int i = 1 ; i < 65 ; i++){
        for(int j = 1 ; j < 65 ; j++){
            table[i][j] = ans[i-1][j-1];
        }
    }
    for(int i = 1 ; i < 65 ; i++){
        for(int j = 1 ; j < 65 ; j++){
            if(table[i][j] != 0) table[i][j] = 1;
        }
    }
    char b,c,d,e;
    for(int i = 0 ; i < 64 ; i++){
        for(int j = 0 ; j < 64 ; j++){
            if(ans[i][j] == 1){
                b = h( table[i+1][j+1] , table[i+1][j+2] , table[i][j+2] , table[i][j+1] );
                c = h( table[i+1][j+1] , table[i][j+1] , table[i][j] , table[i+1][j] );
                d = h( table[i+1][j+1] , table[i+1][j] , table[i+2][j] , table[i+2][j+1] );
                e = h( table[i+1][j+1] , table[i+2][j+1] , table[i+2][j+2] , table[i+1][j+2] );

                int cnt = 0;
                if( b == 'q' ) cnt+=1;
                if( c == 'q' ) cnt+=1;
                if( d == 'q' ) cnt+=1;
                if( e == 'q' ) cnt+=1;

                if( cnt == 1 ){
                    ans[i][j] = 0;
                    table[i+1][j+1] = 0;
                }
            }
            if(ans[i][j] != 0) ans[i][j] = 1;
        }
    }
    return ;
}
```

Step3: loop step2 && step3 until no exchange happen

```
bool change = 1;
while(change){
    change = 0;
    int temp[64][64];
    for(int i = 0 ; i < 64 ; i++){
        for(int j = 0 ; j < 64 ; j++){
            temp[i][j] = ans[i][j];
        }
    }
    yokoi(ans);
    PRO(ans);
    CSO(ans);

    for(int i = 0 ; i < 64 ; i++){
        for(int j = 0 ; j < 64 ; j++){
            if(temp[i][j] != ans[i][j]){
                change = 1;
                break;
            }
        }
        if(change == 1) break;
    }
}
```

Result: