Segmentation 3 (Water shed algorithm)

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1 Pseudo code

In this section we are going to present the pseudo code of the implementation of the algorithm based on [1].First, we are going to present the procedure for arrowing the pixels of the image:

Algorithm 1: Arrowing method

```
Data: and input image I
Result: A list of pixels sets W =< P_1, ..., P_n >;
D is a matrix of directions initialized to Null.
localMinimums = []
for p ∈ I do
    if D(p) ≠ Null then
        // Auxiliary method for finding best neighbour (less
           gray level).
        bestNeighbour = findBestNeighbour(I, p)
        if bestNeighbour = Null then
            // In this case best neighbour is not found so we
               have regional minimum.
            localMinimum := p
            D(p) = CENTER
        if I(bestNeighbour) = I(p) then
            // In this case we should explore the plateau.
            explorePlateau(p, D)
        if I(bestNeighbour) < I(p) then
            // Normal pixel, we have to calculate direction.
            direction = computeDirection(p, bestNeighbour);
            D(p) = direction.
// Finally the watersheds have to be constructed from the
   directions.
W = constructWatersheds(I, D);
```

After that, we are going to explain the procedure of the exploration of the plateau which is the novel method of this algorithm.

Algorithm 2: Plateau exploration method

```
Data: and input image I and an initial pixel p
Q is a queue
P is the plateau
bestNeighbour is the best neighbour of the plateau
Q.add(p)
p := p
while Q.empty() ≠ false do
    currentP = Q.pop()
    // Auxiliary method for finding neighbours.
    for q ∈ Neighbours(I, currentP) do
        if q is not visited then
            mark q as visited
            if I(q) < I(p) ∧ I(q) < I(bestNeighbour) then
                // Best neighbour found
                bestNeighbour = q
            if I(q) = I(p) then
                Q.push(q)
                P := q
if bestNeighbour ≠ Null then
    plateau is not minimal
else
    plateau is minimal
```

2 Example

For testing if the implementation of the algorithm is correct (implementation can be found in the source code), I built an squared image of 10 x 10 pixels, and we can see here the result after applying the segmentation algorithm:

Figure 1: Original image

Figure 2: Watershed regions obtained

References

[1] Suphalakshmi, A and Anandhakumar, P *An improved fast watershed algorithm based on finding the shortest paths with breadth first search*, 2012.