SELECTIVE SEARCH TECHNIQUE

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Selective Search For Object Detection

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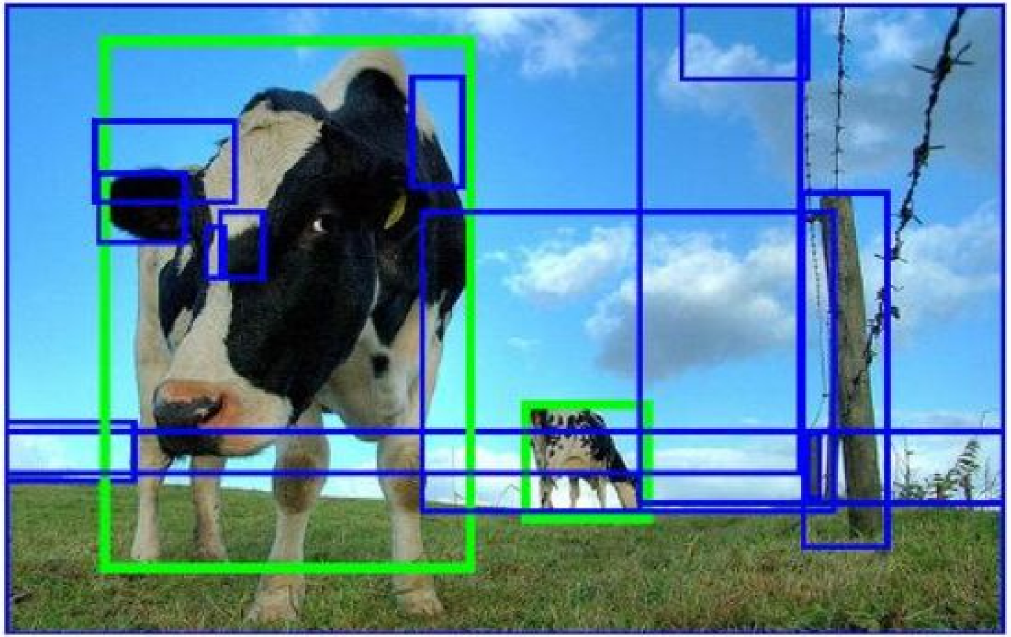
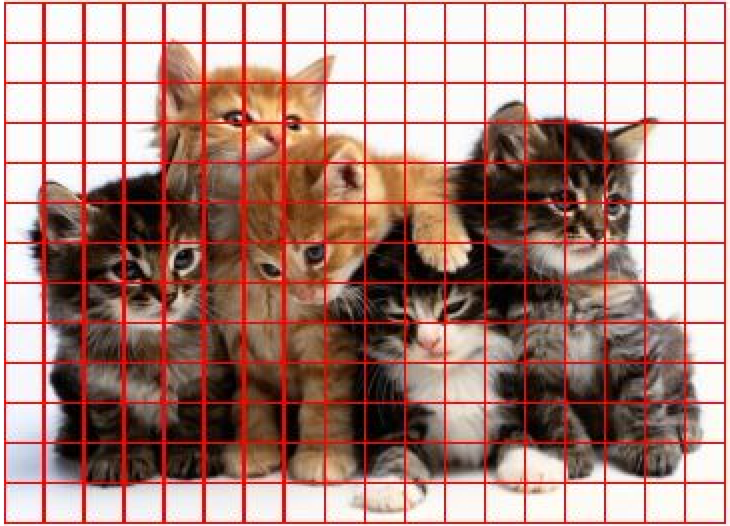
What is selective search technique?

Selective Search is a region proposal algorithm used in object detection.
It is designed to be fast with a very high recall.



Segmentation techniques



Idea: Exhaustive search for objects.

Problem: Extremely slow, must process tens of thousands of candidate objects.

Segmentation Techniques

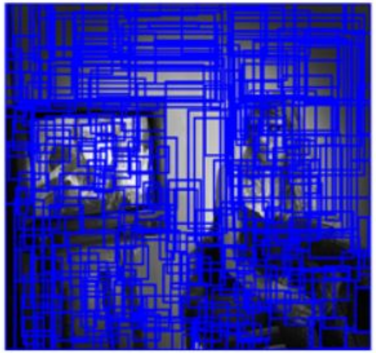
Idea: Need a generic segmentation algorithm.

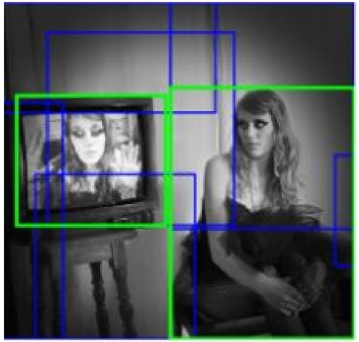
Problem: We may have to use separate segmentation algorithms for each object.

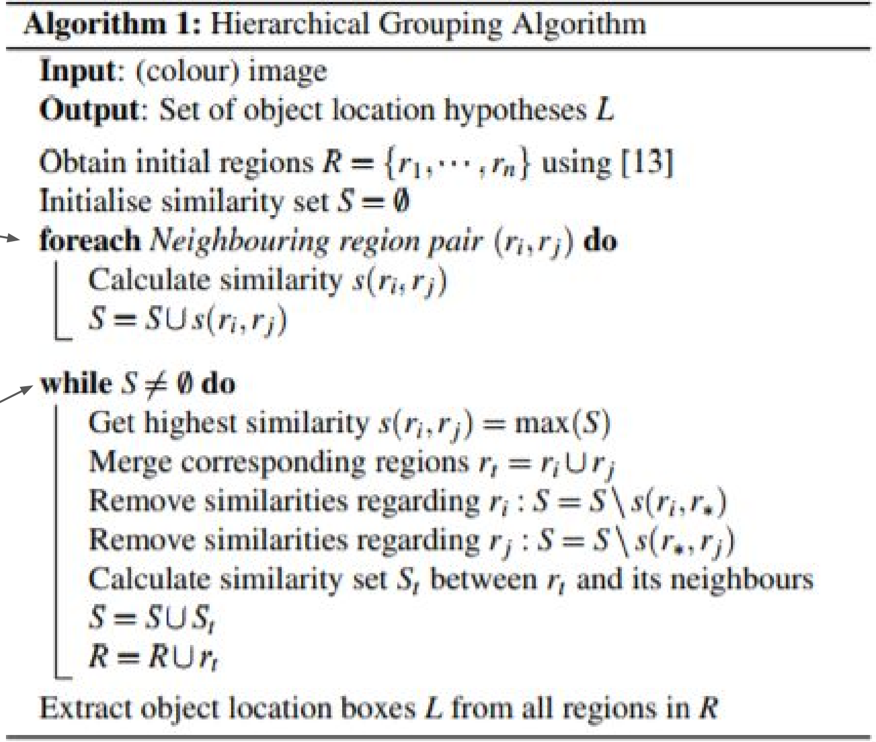
Advantages Selective Search Technique?

1. Can build a generic segmentation technique using region proposals.
2. Object localization.
3. Performance of selective search is fast compared to other region proposal algorithms.
4. Support object recognition.

Algorithm Pseudocode







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Algorithm 1: Hierarchical Grouping Algorithm

Input: (colour) image
Output: Set of object location hypotheses $L$

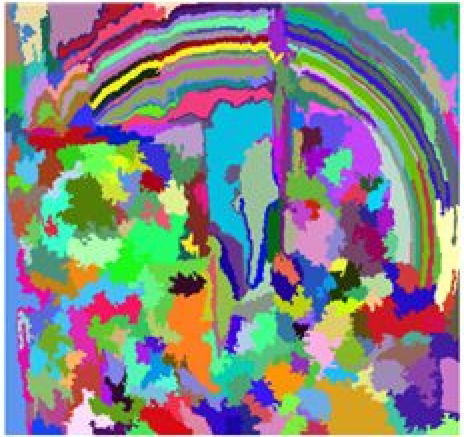
Obtain initial regions $R = \{r_1, \cdots, r_n\}$ using [13]
Initialise similarity set $S = \emptyset$
foreach Neighbouring region pair $(r_i, r_j)$ do
    Calculate similarity $s(r_i, r_j)$
    $S = S \cup s(r_i, r_j)$

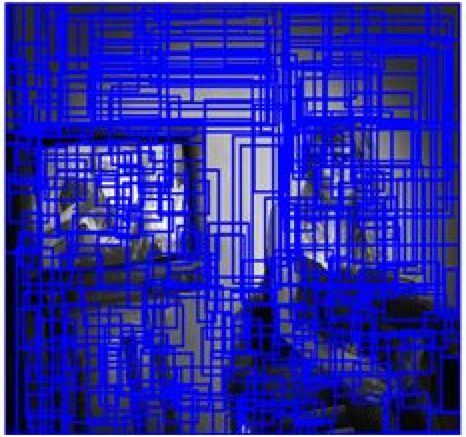
while $S \neq \emptyset$ do
    Get highest similarity $s(r_i, r_j) = \max(S)$
    Merge corresponding regions $r_t = r_i \cup r_j$
    Remove similarities regarding $r_i : S = S \setminus s(r_i, r_*)$
    Remove similarities regarding $r_j : S = S \setminus s(r_*, r_j)$
    Calculate similarity set $S_t$ between $r_t$ and its neighbours
    $S = S \cup S_t$
    $R = R \cup r_t$

Extract object location boxes $L$ from all regions in $R$
```

Algorithm Working

Step 1 : Generate initial sub-segmentation
Segmenting the image based on intensity of the pixels using a graph based segmentation method.





Algorithm Working

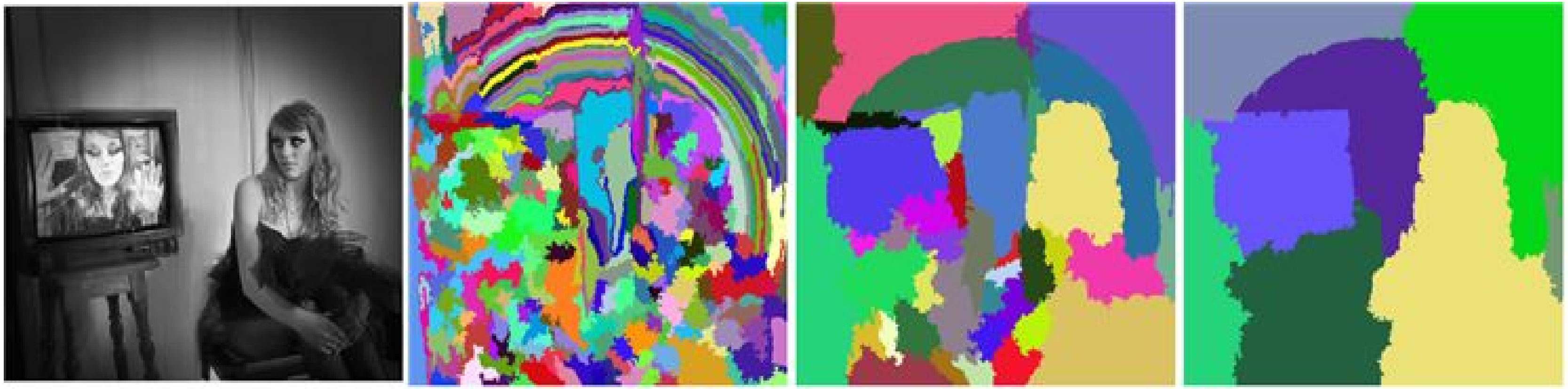
Step 2: Recursively combine similar regions into larger ones.

GREEDY ALGORITHM :

1. From set of regions, choose two that are most similar.

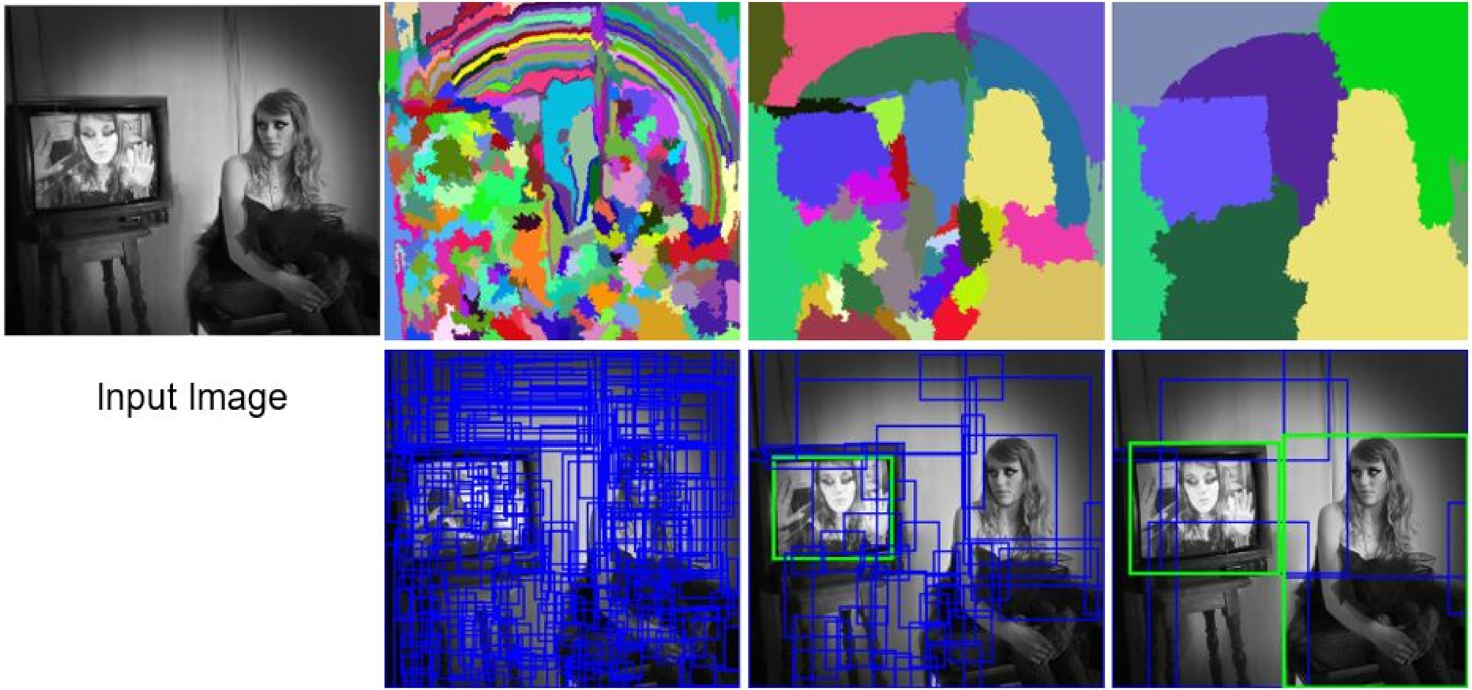
2. Combine them into single larger regions.

3. Repeat until only one region remains.



Algorithm Working

Step 3 : Use the generated regions to produce candidate object locations.



TIME COMPLEXITY

$$O(n)$$

References

1. https://ivi.fnwi.uva.nl/isis/publications/2013/UijlingsIJCV2013/UijlingsIJCV2013.pdf

2. https://www.learnopencv.com/selective-search-for-object-detection-cpp-python/
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THANK YOU