



Automatic, Non-Intrusive Identification of Jaguars In the Wild



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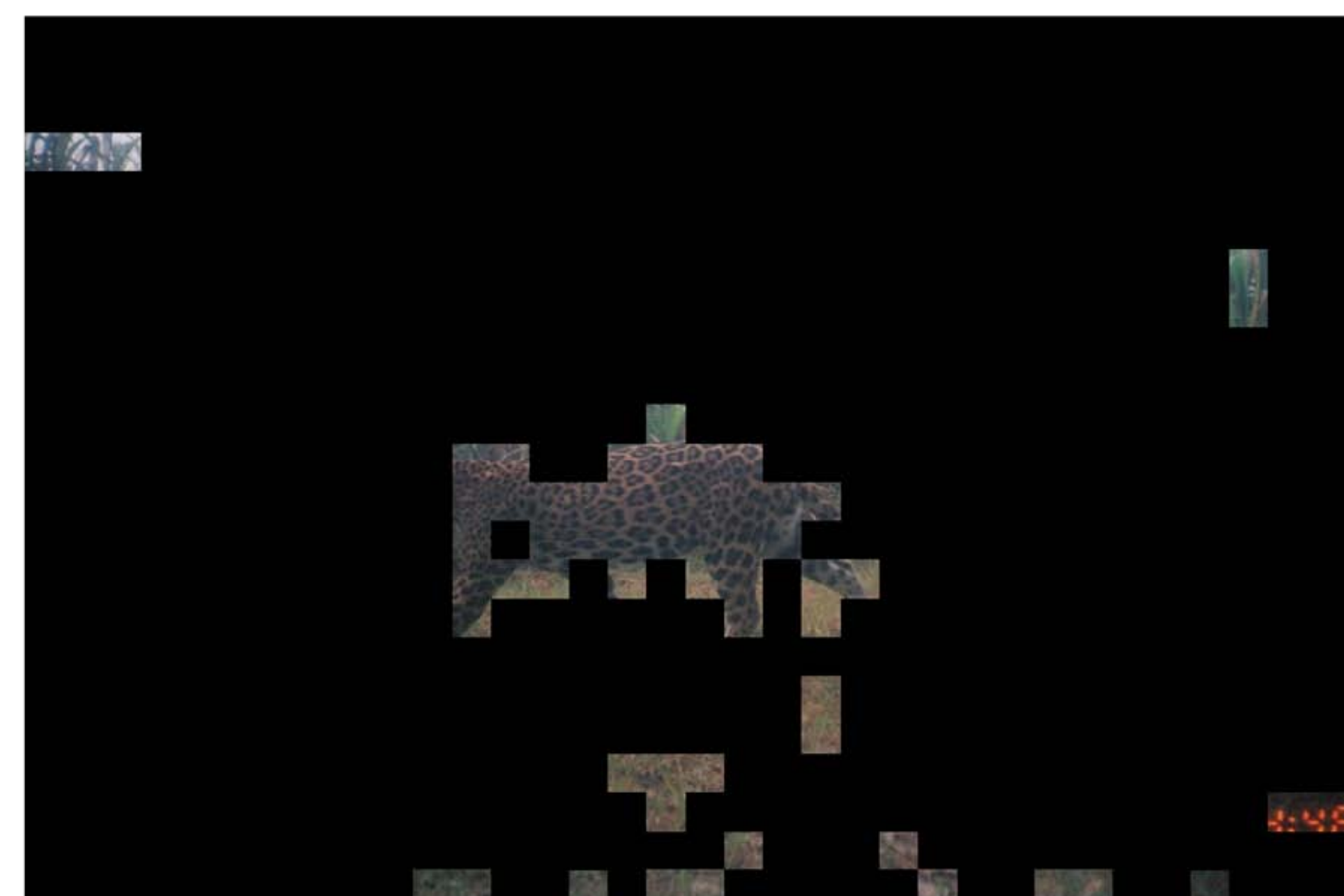
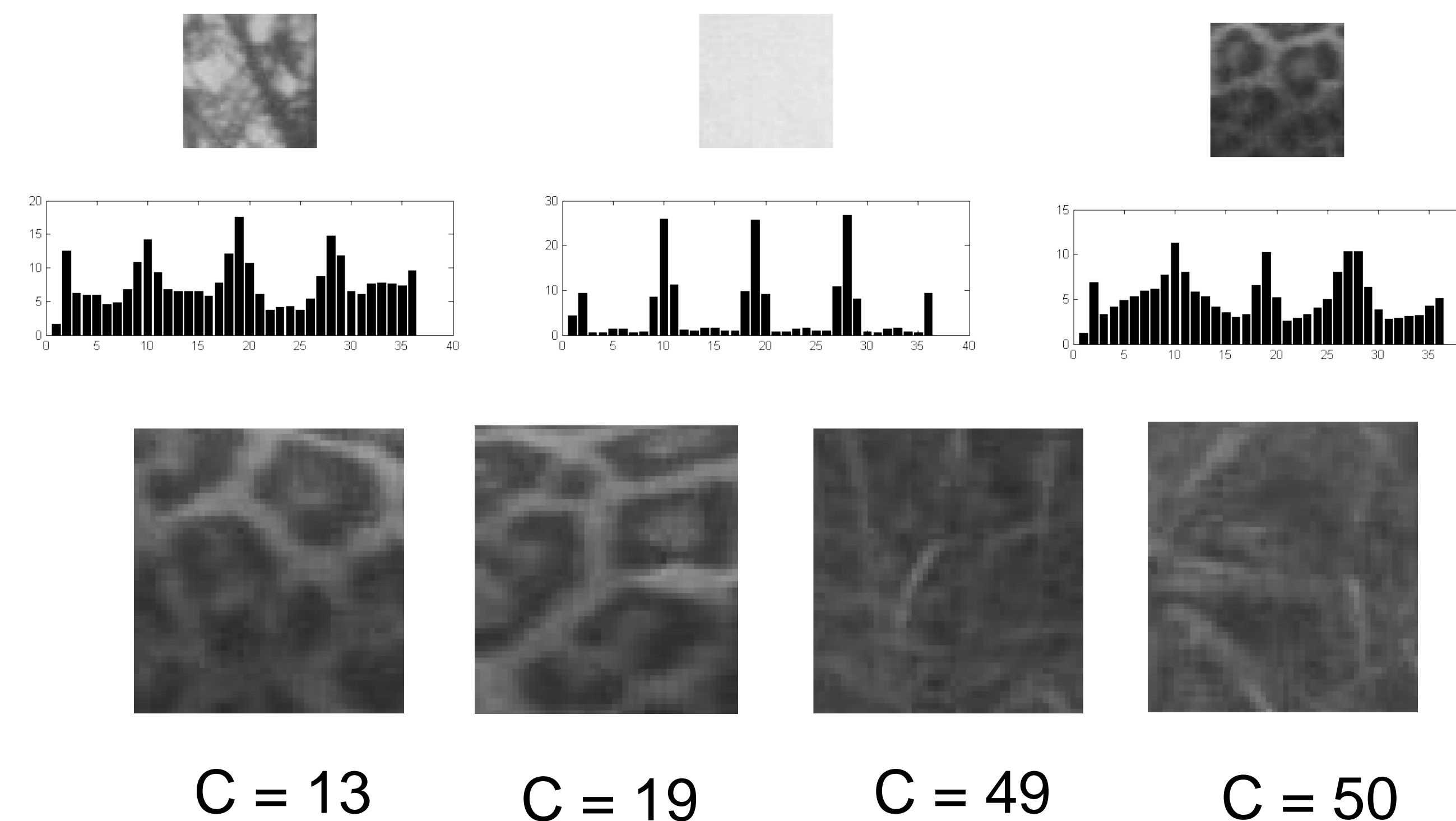
Motivation and Goals

- Identify individual jaguars from photograph data set.
- Reduce time for Ecologist to match Jaguar images
- Near threatened species
- Reasons: deforestation, competition for food, poaching, hurricanes, farmers
- Build up population statistics, density, survival, recruitment

Segmentation

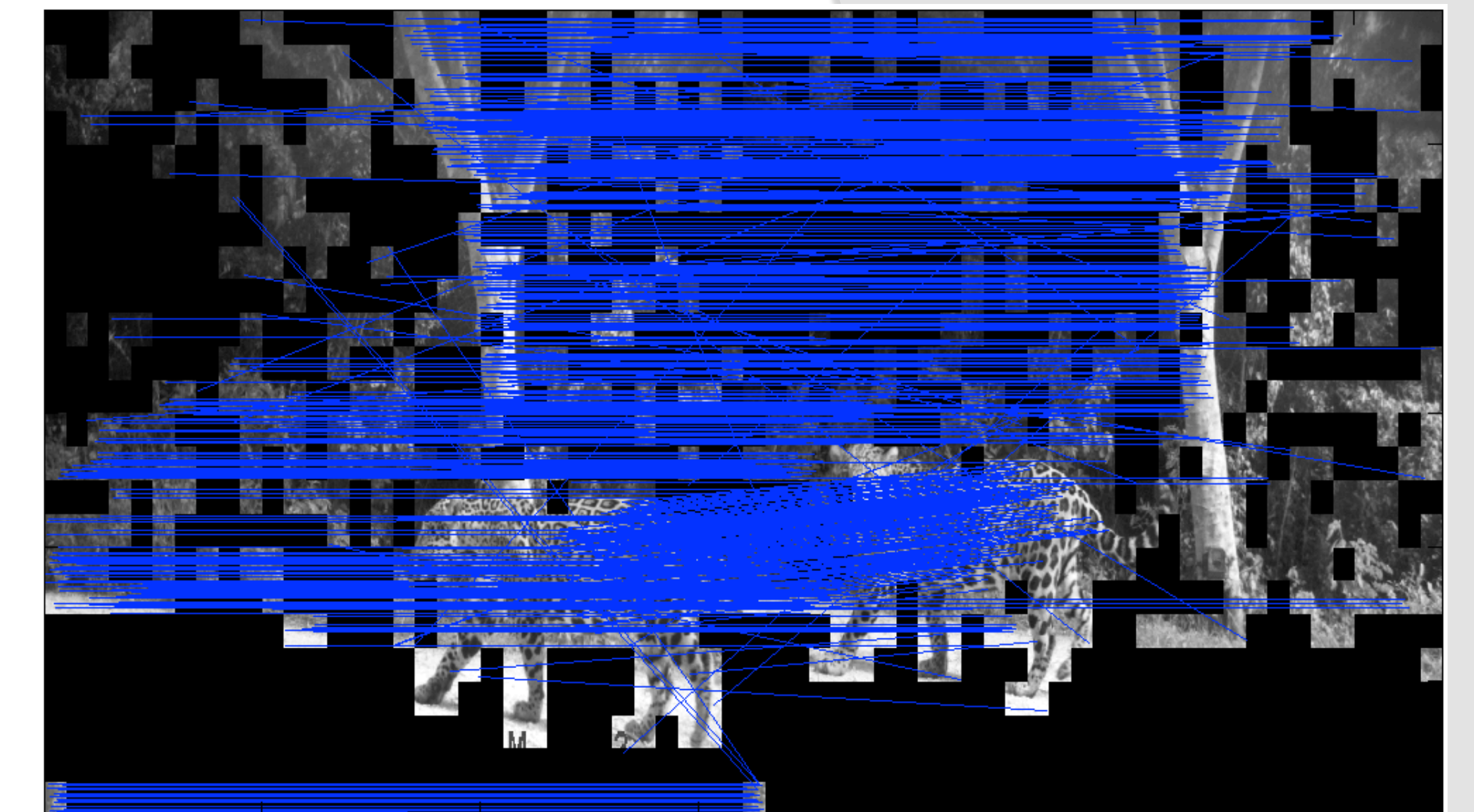
- Find the Jaguar in the Image
- Use a red channel filter for background subtraction
- Split the image into smaller blocks (50x50 pixels)
 - Look at the gradients
 - Background region's gradient directions will be consistent (e.g. along a tree branch)
 - Jaguar region's gradient directions will be more uniform
 - Created a histogram of oriented gradients
 - Each gradient votes for two bins
 - The vote is weighted by the magnitude, e.g. if the magnitude is larger the vote counts more
- Examine compactness of regions remaining

$$compactness = \frac{perimeter^2}{4\pi area}$$



Matching

- Compare rosette patterns to earlier patterns
- Form matches and return whether same or new jaguar
- Four Stages of Matching
 - Generation of local interest points
 - Computation of SIFT descriptors
 - SIFT matching using nearest neighbor descriptors
 - Transformation computation and hypothesis rejection tests



Results

- 89% Accurate, despite many images being of low quality
- Only 2 false negatives in 146 images and 14 false positives
- Could easily be implemented such that the system suggests potential matches and the user can either confirm or deny the matches

References

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- Lowe, D.: Object Recognition from Local Scale-Invariant Features. *International Conference on Computer Vision 2*: 1150 -- 1157 (1999)
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- Wallace, R.B., Gomez, H., Ayala, G., Espinoza, F.: Camera Trapping Capture Frequencies for Jaguar (Panthera onca) in the Tuichi Valley, Bolivia. *Mastozoologia Neotropical* 10(1): 133 -- 139 (2003).