Feather Analysis
for the
Barn Owl

Technion
Israel Institute of Technology

Electronics
Computers
Communications

SIPL

Commissioned by

Executor
Naftali Kizner

Supervisors
Yuval Bahat
Ori Bryt

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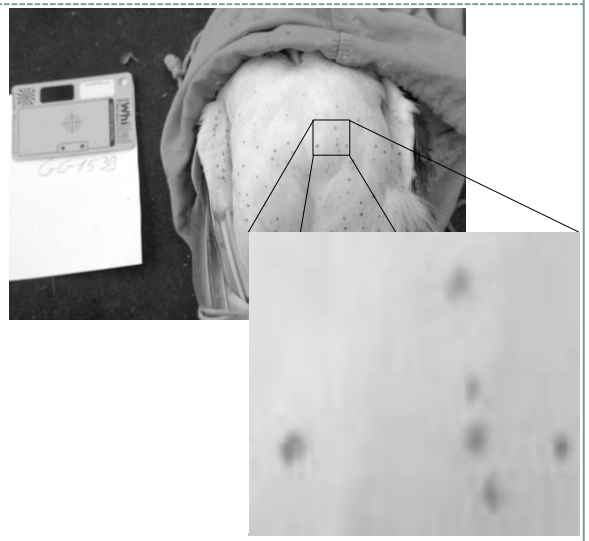
Background

- Barn owls serve mankind as natural pest controllers
- A research is being conducted in Tel Aviv University
  - The connection between barn owls' life conditions and their appearance
  - Researchers capture and photograph owls
  - Analyze the visual features of spots and stains located on their belly
- In this project, we computerize this analyzing process

objectives

- Analyzing spot patterns
  - Number of spots, density, average area, average eccentricity, average distance to the nearest spot
- Measuring plumage color
- Feather shape analysis



challenges

- The pictures are taken in a variety of lighting conditions
- Camera's dynamic parameters

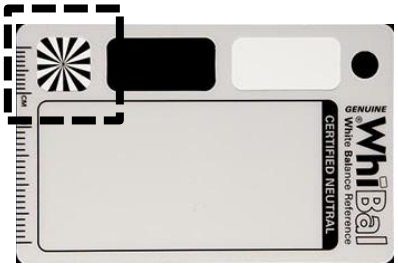
- Many different spot sizes and shapes
- Non-uniform lighting of the owl

solution

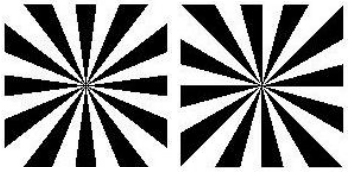
- Using a white-balance (gray) card
  - Image calibration
  - Pixel-to-cm ratio determination
- Finding spots using edge detection and not brightness-related methods
- Adjusting thresholds according to the user defined block

WB (white balance) card recognition

- We search for the card's "sun" by a 2D correlation



- Only two correlation kernels are needed
  - Rotated relatively by ¼ black-white cycle
  - No need of 4 kernels because opposite kernels give identical correlation results (in absolute value)



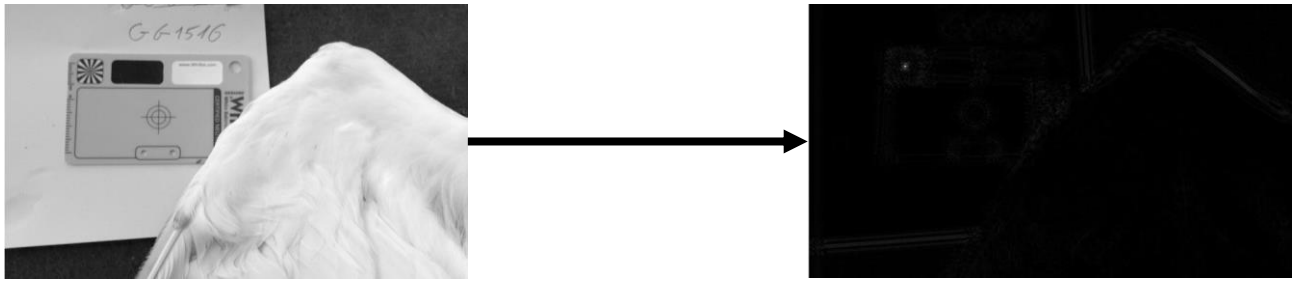
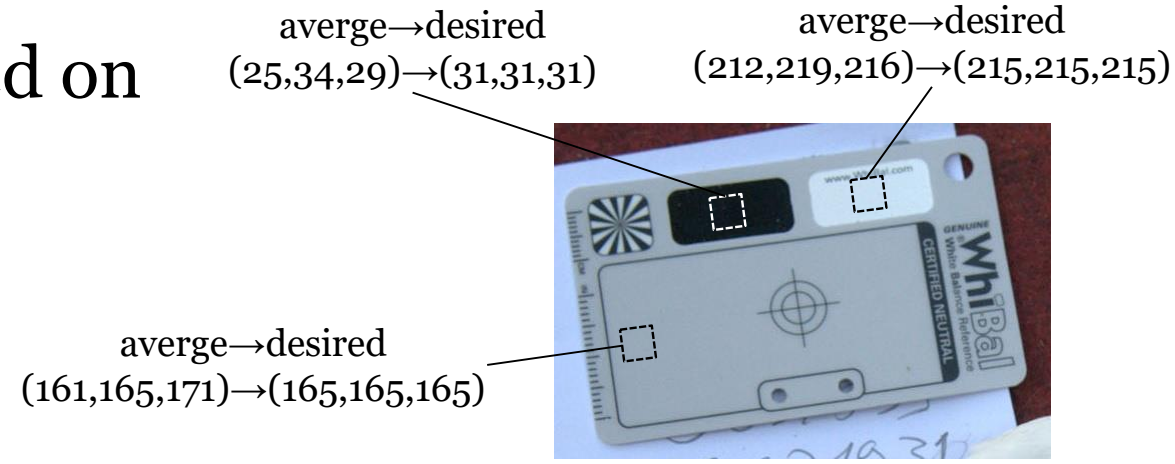


Image calibration

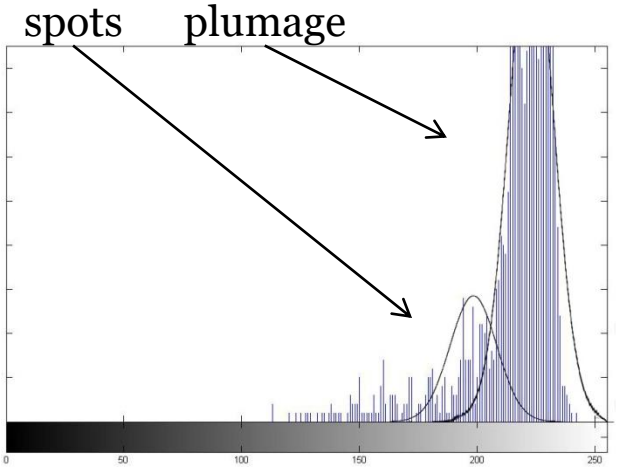
- Finding the WB card's size and angle
  - Using 175 correlation vectors
- Building a Look Up Table by matching values of certain areas of the WB card to desired values
- The LUT is applied on the whole image



Area selection

- The user will be given 3 area selection methods:
  - A 64× cm movable square
  - A movable & resizable square
  - A free hand border drawing

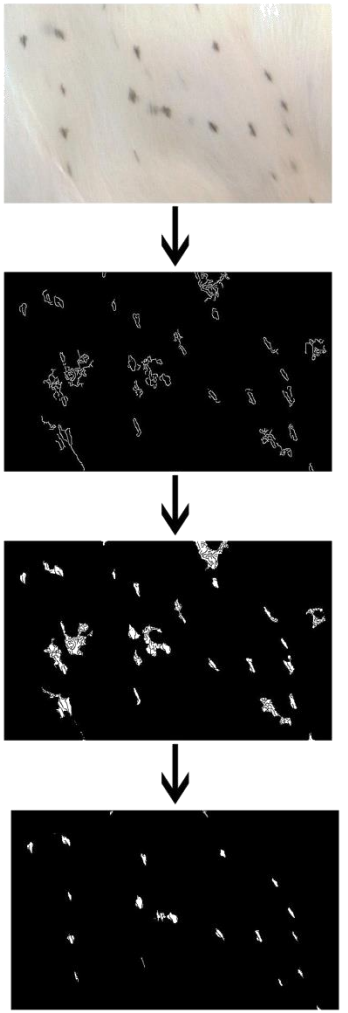
- An expected spot brightness will be extracted from the selection's histogram



Gaussian histogram modeling

Spot identification

- Using Canny algorithm for edge detection
- Filling any closed loops formed
- Eliminating too large/small objects
- Eliminating too bright objects
  - If too many objects were eliminated, then edge detection repeats with other thresholds



Information extraction

- Taking the spot mask and separating its connected components into objects
- Determining each object's relevant features and processing all individual features into statistical information
- Plumage average color is calculated by averaging the non-spot pixels

Data editing GUI

- The user can delete unwanted spots
- The user can request a re-identification of a spot by clicking on it
  - An enhanced algorithm will be applied locally

1	size [cm²]	eccentricity	nearest distance [cm]
2	2.0732	0.52	4.46
3	0.7042	0.93	3.82
4	2.5090	0.85	3.25
5	1.5212	0.14	2.31
6	0.5835	0.48	5.34
7	1.3321	0.69	3.82
8	1.8140	0.16	5.10
9	0.5764	0.52	2.05
10	2.8616	0.28	1.28
11	1.2162	0.67	2.73
12	1.3374	0.91	3.29
13	2.0787	0.83	3.17
14	0.6073	0.04	0.21
15	0.3218	0.16	3.67
16	2.7515	0.43	2.47
17	1.7097	0.27	3.61
18	2.5196	0.95	1.44
19	2.0392	0.19	4.10
20	2.7275	0.16	3.58
21	1.5411	0.21	5.91
22	2.2207	0.94	4.06
23	1.7341	0.11	4.98
24	2.2552	0.98	0.68
25	2.9792	0.62	4.18
26	2.8057	0.01	4.63
27	1.7764	0.39	1.91
28	1.3952	0.96	2.81
29	0.5253	0.14	5.77
30	1.0579	0.59	5.33

All spots are circled; selected spot is fully marked

Results

- Data will be displayed in cm^2 and in any color space of the user's choice