ELLIPSE DETECTION IN A TWO-DIMENSIONAL IMAGE
CASE STUDY: VEHICLE DETECTION

Mehrdad Ghyabi
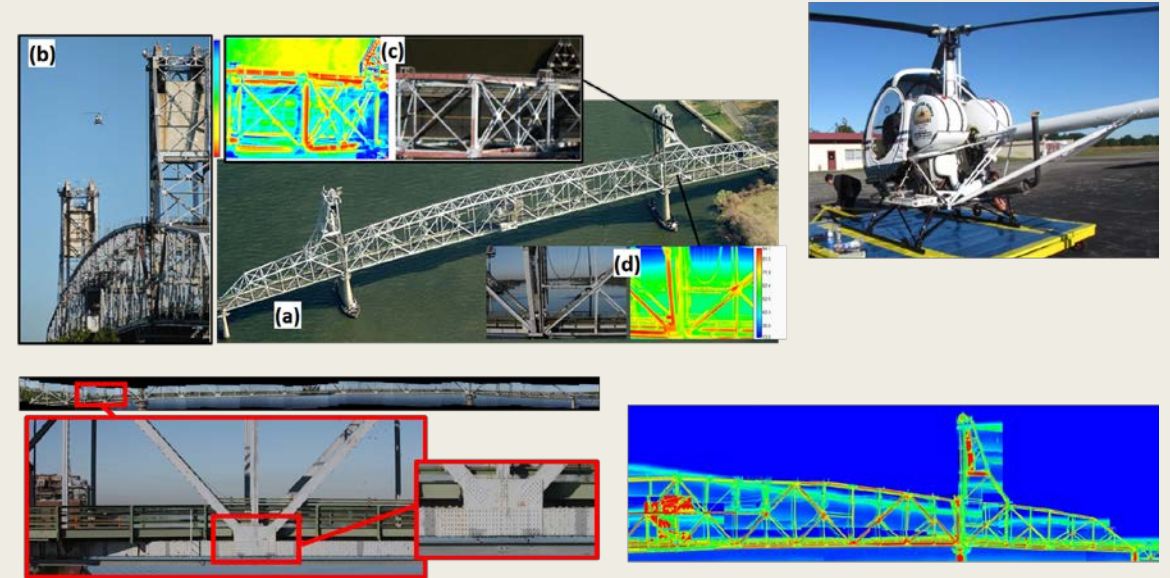
Spring 2018

Introduction

- Vision Based Structural Health Monitoring
- Measuring Deformations and Stresses
- Detecting Circular and Elliptical Patterns

Overview

■ Car Wheel Detection

■ Picture Processing Procedure

■ Ellipse Detection

■ Results

Car Wheel Detection

Hutter, M. and Brewer, N., 2009, November. Matching 2-D ellipses to 3-D circles with application to vehicle pose identification. In *Image and Vision Computing New Zealand, 2009. IVCNZ'09. 24th International Conference* (pp. 153-158). IEEE.

- Wheel Covers or Rings

- Statistical Properties of an Ellipse

Procedure: Mean Image

Original Image

Mean Image (Window Size 10%)

- Intensity Difference between Pixels and Their Neighborhoods
- Averaging without Padding

Procedure: Bright Spots

Subtracted Image

- Setting Threshold
- I<T→0, I≥T→1
- Tradeoff between Filling and Irrelevant Data

T=μ + 0.5×σ

T=μ + 1.5×σ

T=μ + 2.5×σ

All About Discovery!
New Mexico State University

Procedure: 8-Adjacency

- Using Convolution

- Kernel$= \frac{1}{8} \times \begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{bmatrix}$
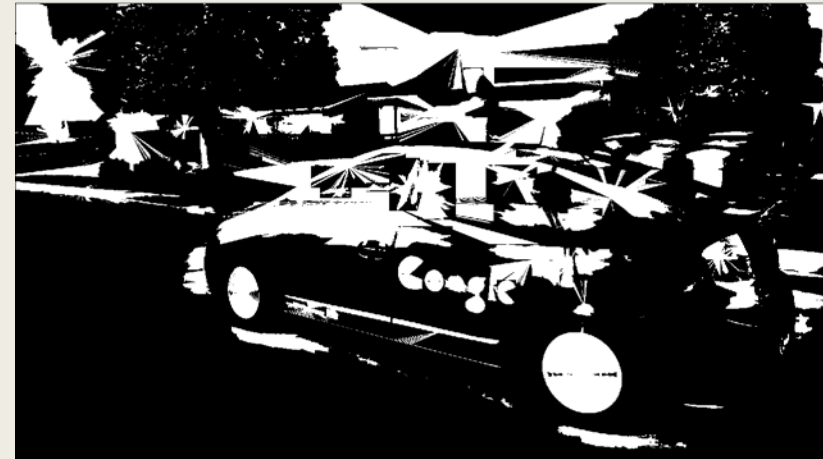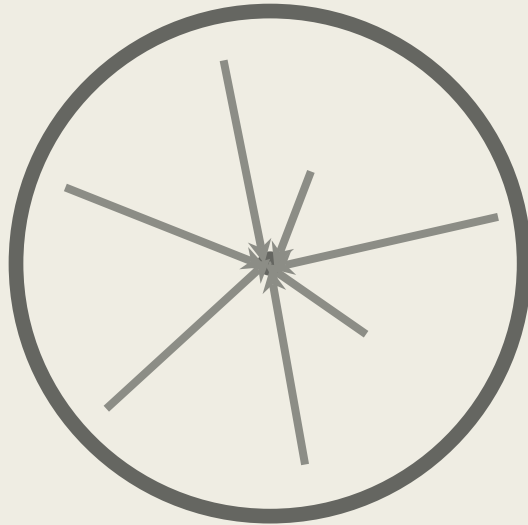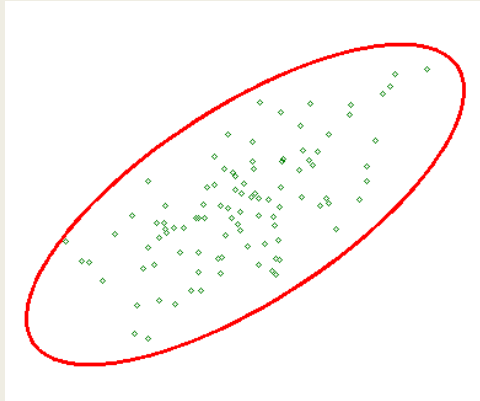
- I<1→0

- Detecting Different Adjacencies

Procedure: Radial Fill

- Drawing Lines between every Pixel in Adjacency and Centroid
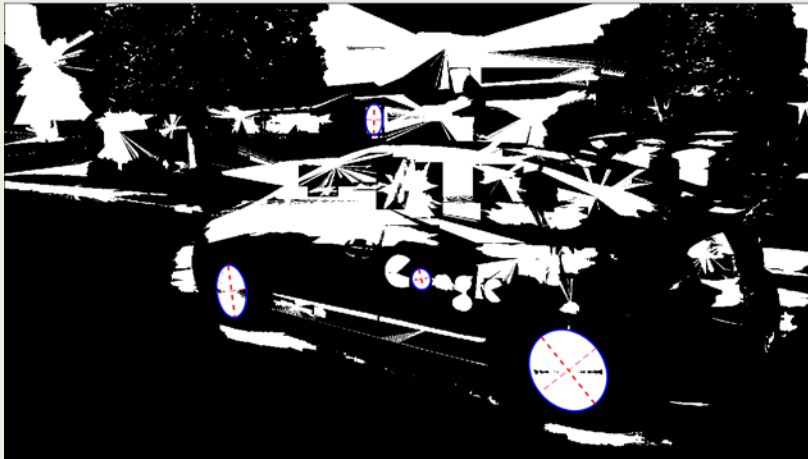
Ellipse Statistical Properties

$$|W| = \sum_{p \in W} 1$$
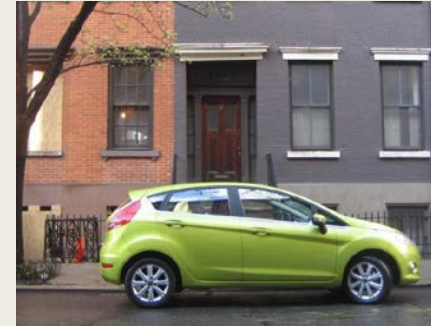
$$\mu = \frac{1}{|W|} \sum_{p \in W} p$$

$$C = \frac{1}{|W|} \sum_{p \in W} (p - \mu)(p - \mu)^T$$

$$\left| |W| - 4\pi\sqrt{detC} \right| > T$$

Final Result

Results

Thank You for Your Attention

Any Questions?