

Modeling with Unstructured Data

May 20th, 2015



SERVE | ADD VALUE | INNOVATE

Imagery for Business Decisions





Topics to Discuss

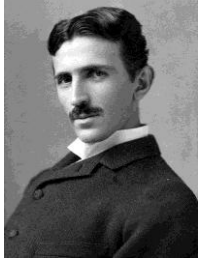
- Imagery analytics
 - Historic timeline of imagery
- Extracting data from images
- Common uses today
- Applications within insurance
 - Roof dimensions & inspections
 - License plate readers & vehicle rec





Timeline of Imagery

First patent for remote UAV by Nikola Tesla



Digital images in real time

First digital image



Drones approved by FAA and available to consumers

1826

1898

1916

1920

1962

1966

1996

2014

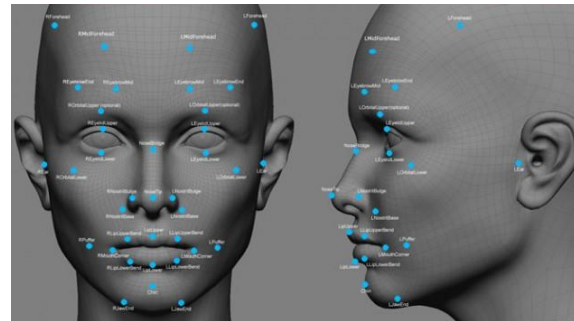
WWI starts collection of aerial imagery



First photograph by Joseph Niepce



Facial recognition developed



High Def Image and Video DVB (1080p, 720p, etc.)





Current uses of image analytics

- Driven by military and defense
- Security – city cameras
- Healthcare a perfect domain
- Marketing research
- Sports



Predator drone



Lung imaging

[+] Enlarge



Brad Penner/USA TODAY Sports

The Bucks used Dan Hill's facial coding research as one of the determining factors in selecting Jabari Parker with the No. 2 overall pick in the NBA draft.





Extracting Data From Images

- An image is a set of signals sensed by the human eye and processed in the brain to instantly associate objects and concepts previously received and stored in memory
- To a computer, an image is either a sequence of pixels or set of color-annotated polygons.

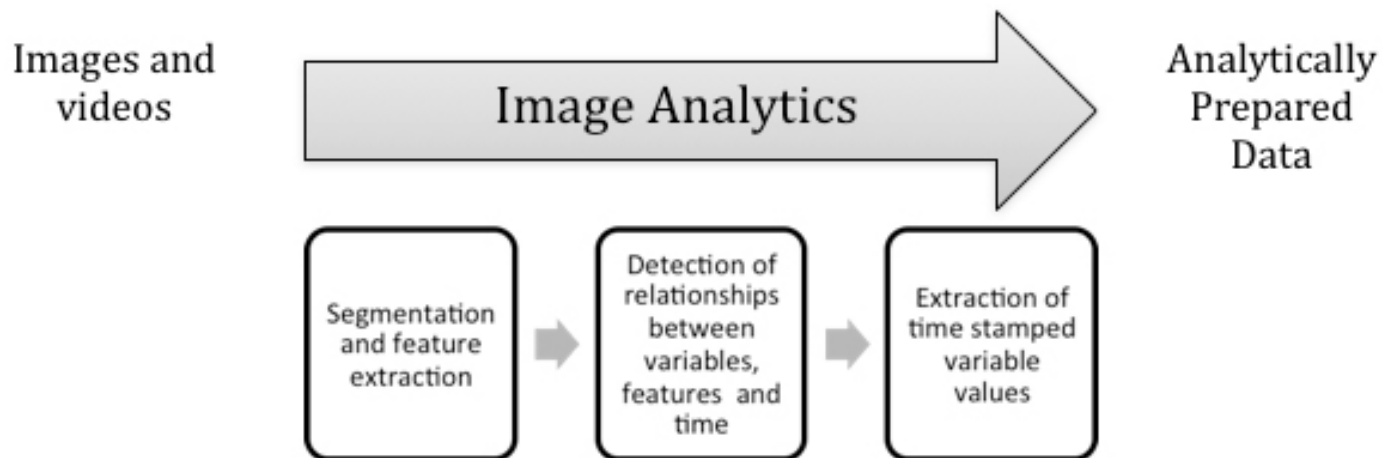




Image Transformation

- Image segmentation algorithm – process image to identify edges, boundaries, regions, etc. Popular algorithms include: boundary detection, color gradients, contour maps, and multi-scale gradient magnitudes
- Feature extraction – assists in the detection of higher-level characteristics and low-level features are extracted and stored with each instance. Common algorithms include: shape identification, color histograms, differential geometry operators, and scale transformations
- A wide variety of software and languages can be used including C+, MATLAB, Sony Image Converter, etc.



Image Transformation

- Image segmentation vs. feature extraction

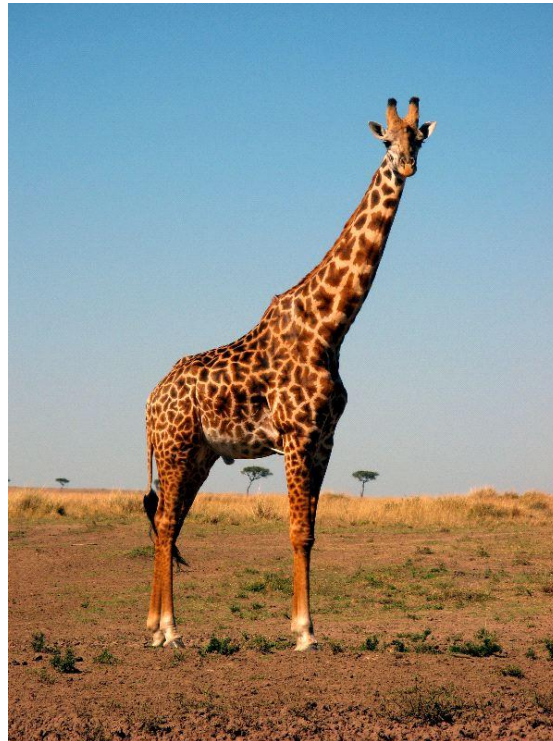
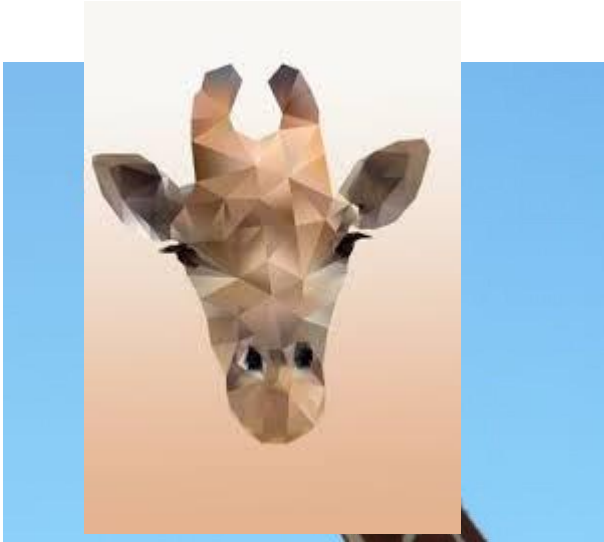




Image Segmentation



```
[~, threshold] = edge(I, 'sobel'); Detects image – high contrast detection
```

```
fudgeFactor = .5;
```

```
BWs = edge(I, 'sobel', threshold * fudgeFactor);
```

```
figure, imshow(BWs), title('binary gradient mask');
```

```
se90 = strel('line', 3, 90);
```

```
se0 = strel('line', 3, 0);
```

Fills gaps in image outlines

```
BWsdil = imdilate(BWs, [se90 se0]);
```

```
figure, imshow(BWsdil), title('dilated gradient mask');
```

```
BWnobord = imclearborder(BWsdil, 4); Removes outside “junk”
```

```
figure, imshow(BWnobord), title('cleared border image');
```

```
seD = strel('diamond', 1);
```

```
BWfinal = imerode(BWnobord, seD);
```

Smooth object to look natural

```
BWfinal = imerode(BWfinal, seD);
```

```
figure, imshow(BWfinal), title('segmented image');
```

```
BWoutline = bwperim(BWfinal);
```

```
Segout = I;
```

```
Segout(BWoutline) = 255;
```

Overlay the original

```
figure, imshow(Segout), title('outlined original image');
```



Getting Data From Images

```
confidence: 95
- mood: {
  value: "angry",
  confidence: 93
},
- tongue: {
  value: "in",
  confidence: 95
},
confidence: 95
- mood: {
  value: "happy",
  confidence: 86
},
- tongue: {
  value: "in",
  confidence: 95
},
confidence: 95
- mood: {
  value: "neutral",
  confidence: 85
},
- tongue: {
  value: "in",
  confidence: 95
},
confidence: 95
- mood: {
  value: "sad",
  confidence: 90
},
- tongue: {
  value: "in",
  confidence: 95
}
```



Odometer reading – 91,308

While a picture may not always be worth 1,000 words,
There is still plenty of value information

Applications within Insurance





Applications in Insurance

- Roof dimensions & inspections
- Estimating damage & losses
- Validating application & claim information
- License plate readers & vehicle recovery





Roof Inspections

- Roof dimensions and materials remain a hot topic in homeowners for loss estimates
- Roof inspections are costly and one of the most dangerous tasks associated with property estimating.





Aerial Damage Investigation



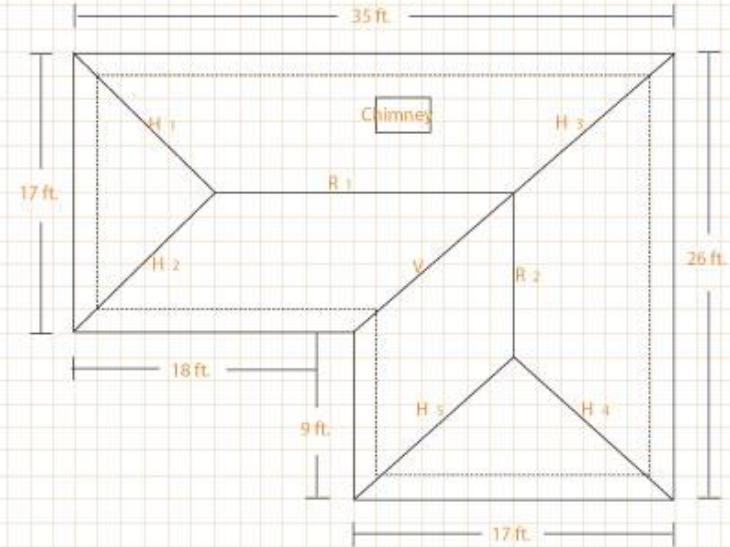
Investigate Damage Virtually



Roofing Dimensions – Aerial Sketch



- R 1 = 18 ft.
- R 2 = 8 1/2 ft.
- V = 12 1/2 ft
- H 1 = 12 1/2 ft.
- H 2 = 12 1/2 ft.
- H 3 = 12 1/2 ft.
- H 4 = 12 1/2 ft.
- H 5 = 12 1/2 ft.
- Overhang = 2 ft.
- Slope = 6/12



Sample roof sketch with measurements.



Vehicle Damage Estimates

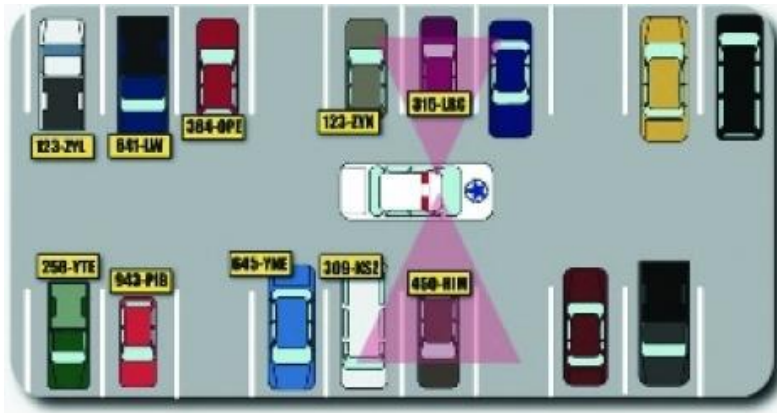
- More and more companies and repair shops are getting faster damage estimates from pictures. Most of the work is still manual, but automation is in progress.





License Plate Readers

- Captures license plate numbers, location and time
- Stationary cameras and mobile cameras
- Can determine where a car is at a given time
- Theft recover applications
- Garaging address validation



Thank You

Douglas Wing
dwing@iso.com

