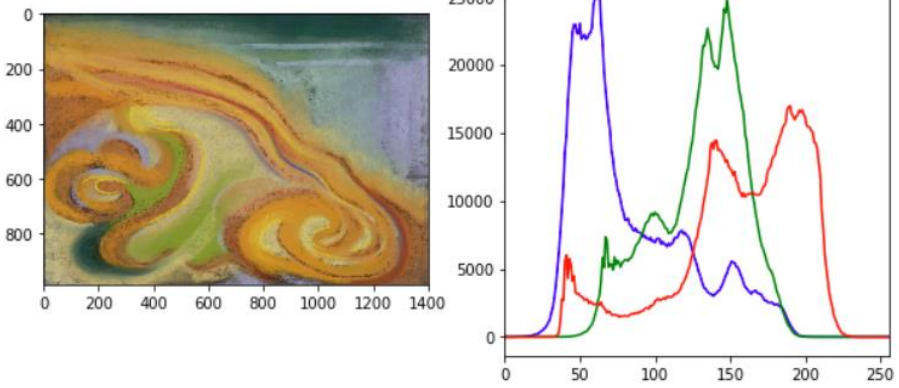
Image Processing, part 2

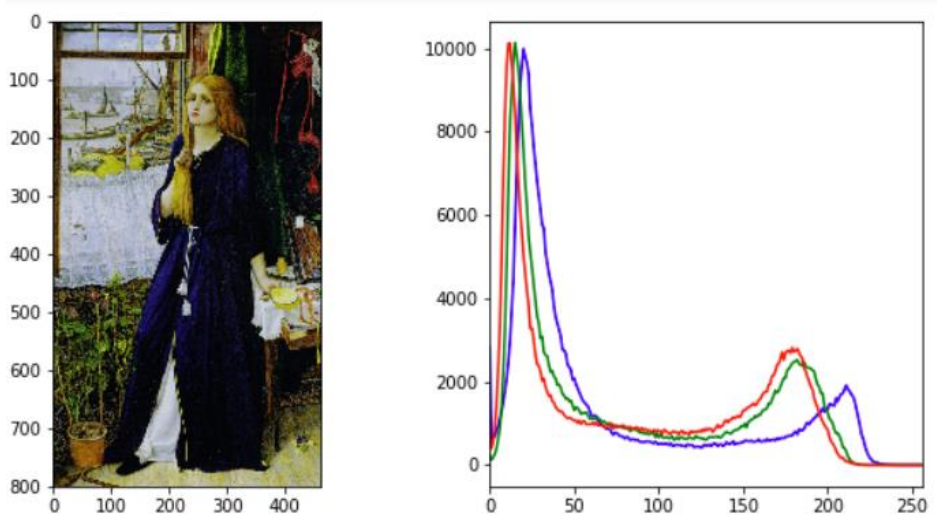
PABLO MALDONADO

Image Pyramids

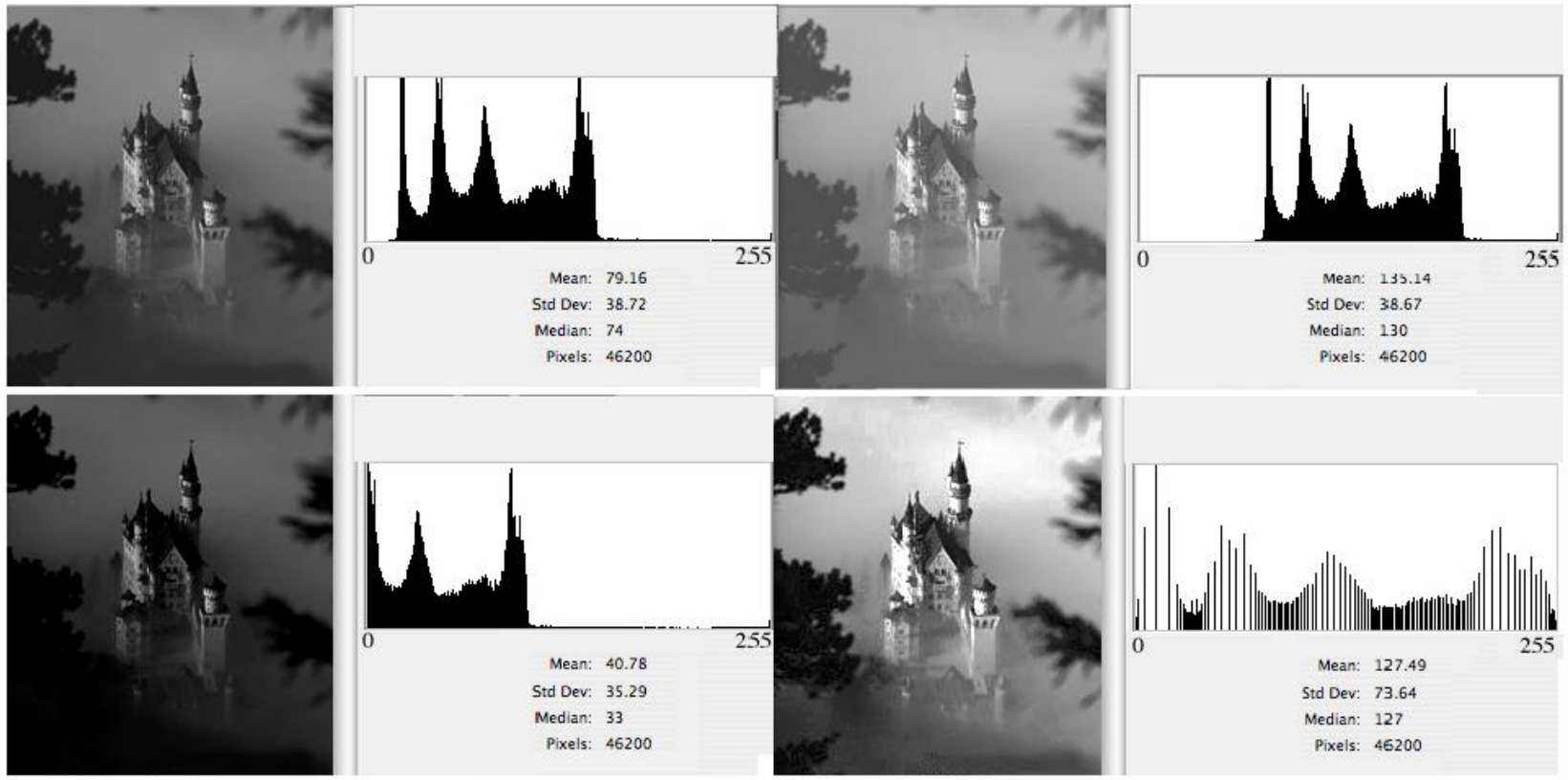
Histograms

Color distribution as descriptors



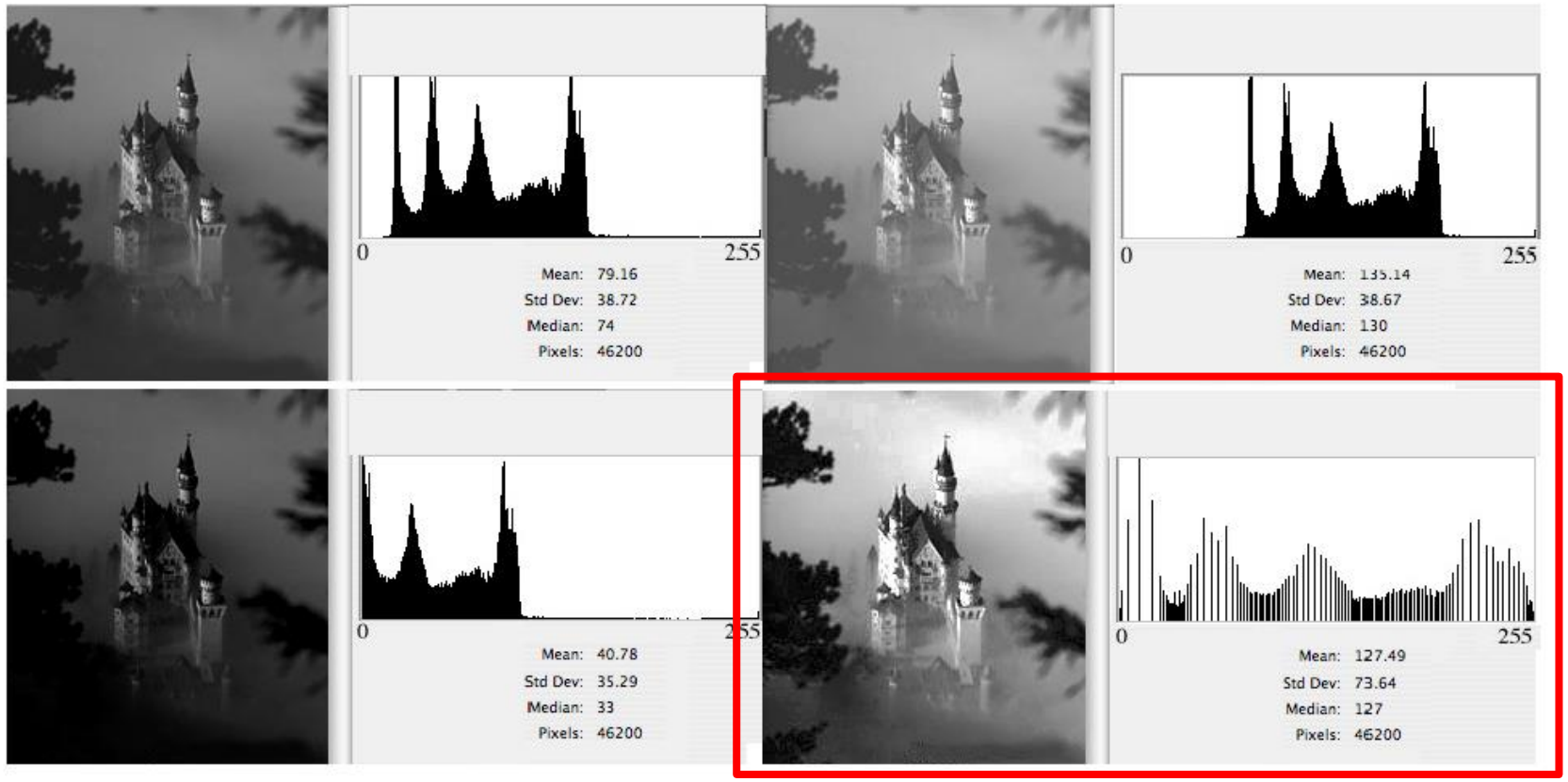


Effect of brightness

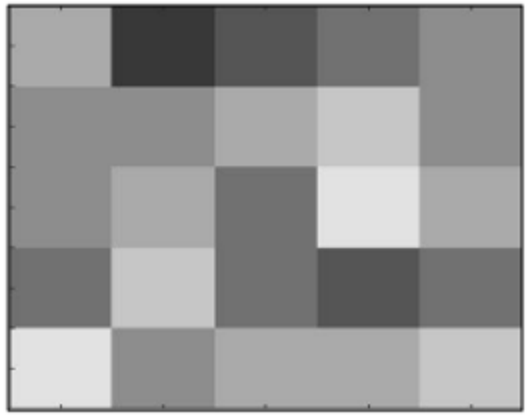


R. Klette. Concise Computer Vision.
©Springer-Verlag, London, 2014.

Effect of brightness



R. Klette. Concise Computer Vision.
©Springer-Verlag, London, 2014.



6	2	3	4	5
5	5	6	7	5
5	6	4	8	6
4	7	4	3	4
8	5	6	6	7

https://flir.custhelp.com/ci/fattach/get/40007/0/filename/Histogram+equalization.pdf

Histogram Equalization

Intensity	Frequency
0	0
1	0
2	1
3	2
4	5
5	6
6	6
7	3
8	2
9	0

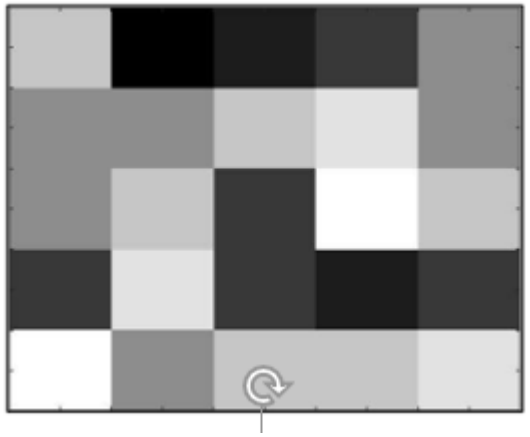
Table 1

$$s = T(i) = floor((L-1) * \sum_{k=0}^{i} p_k) = floor(9 * \sum_{k=0}^{i} p_k)$$

i	T(i)
0	0
1	0
2	0
3	1
4	2
5	5
6	7
7	8
8	9
9	9

Table 2

https://flir.custhelp.com/ci/fattach/get/40007/0/filename/Histogram+equalization.pdf



7	0	1	2	5
5	5	7	8	5
5	7	2	9	7
2	8	2	1	2
9	5	7	7	8

https://flir.custhelp.com/ci/fattach/get/40007/0/filename/Histogram+equalization.pdf

Localized histograms

R. Klette. Concise Computer Vision.
©Springer-Verlag, London, 2014.

Template Matching

- Similar to convolutions, we pass a template image across a moving window and calculate a “similarity score”.
- The output is an array/”similarity heatmap” that contains the most likely matches.
- Different criteria for similarity.

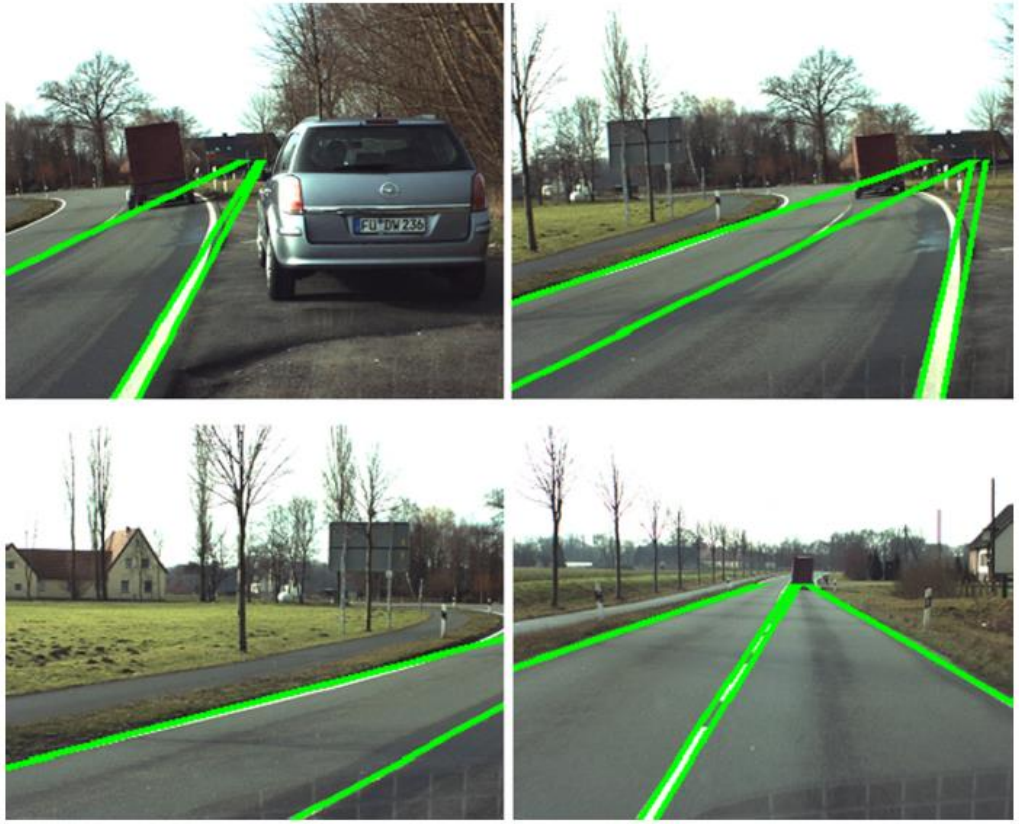
Example

image

https://docs.opencv.org/4.0.0/d4/dc6/tutorial_py_template_matching.html

Hough Transform

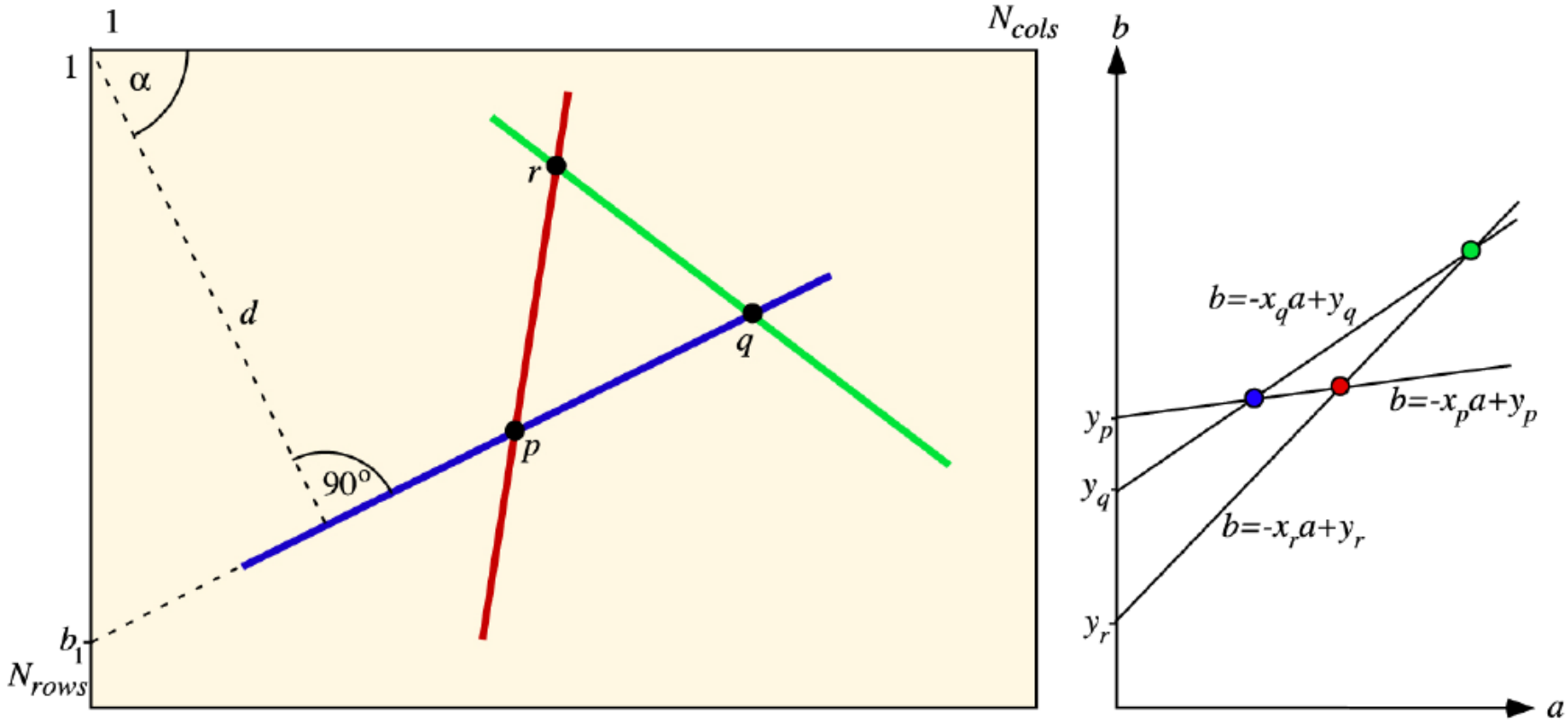
Motivation: Lane detection



R. Klette. Concise Computer Vision.
©Springer-Verlag, London, 2014.

- Use a (robust) edge detector to get a binary edge map.
- Check if the remaining pixels make a segment.
- This last step is sensible to noise. Instead, we look at the lines in their **parameter space**.

Image vs Parameter space

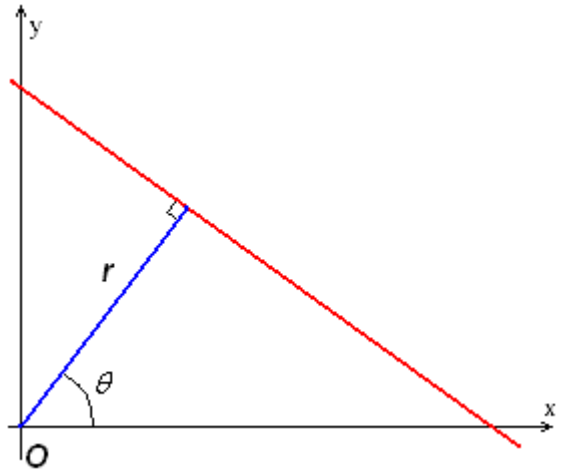


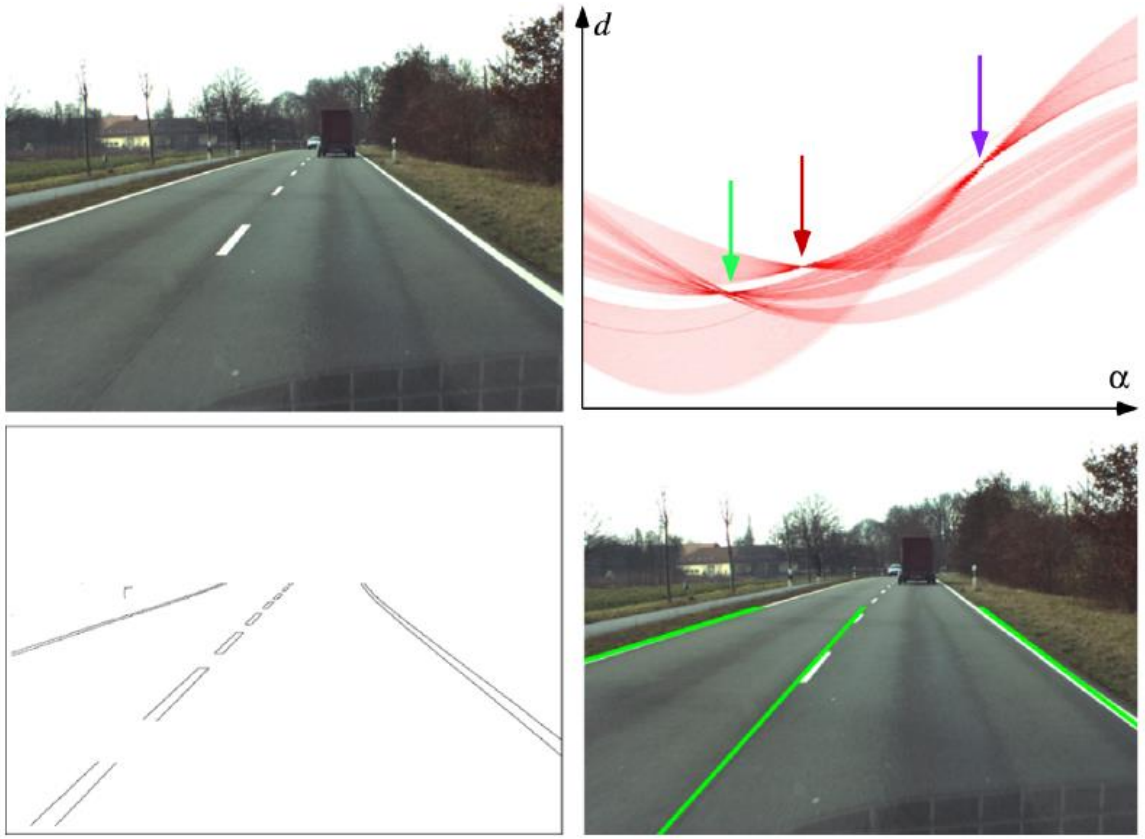
R. Klette. Concise Computer Vision.
©Springer-Verlag, London, 2014.

- However, the parameter space (a,b) has a small problem: you cannot represent vertical lines with finite values.

- Instead, we use the **Hesse normal form** to parameterize a line.

- In this parameter space, points = sinusoidal curves.

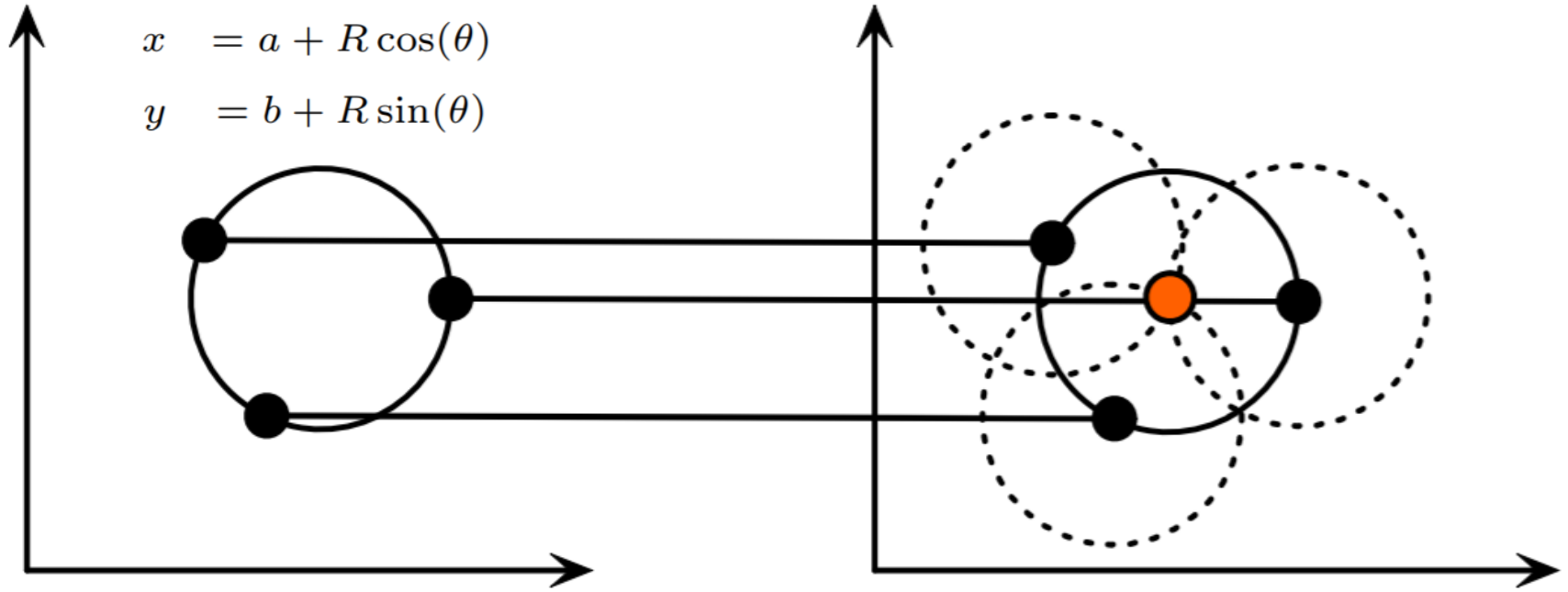


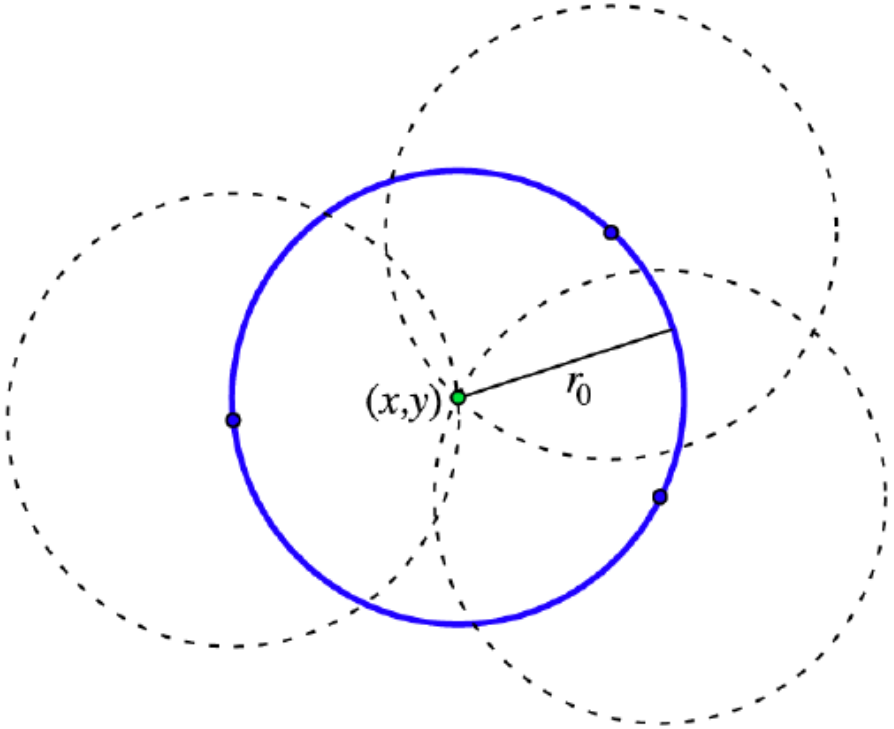
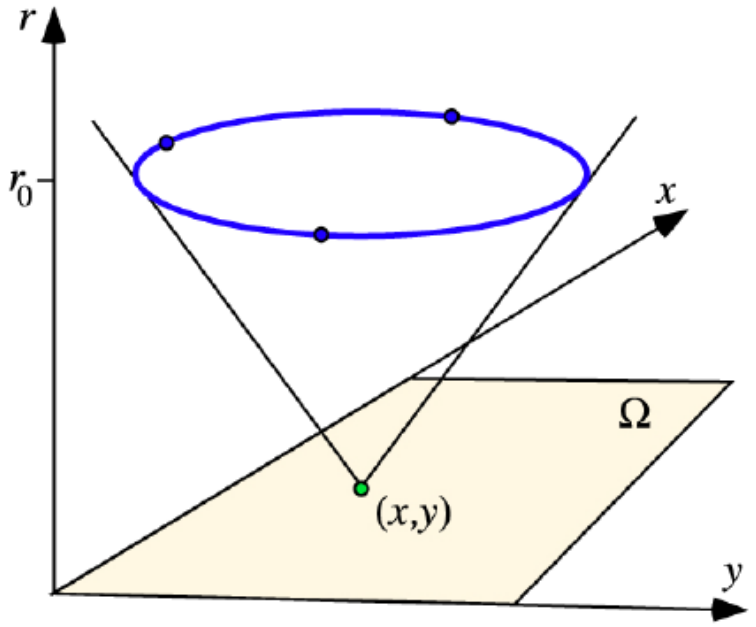


R. Klette. Concise Computer Vision.
©Springer-Verlag, London, 2014.

Circle detection

Circle detection: Fixed radius



Each point in geometric space (left) generates a circle in parameter space (right). The circles in parameter space intersect at the (a, b) that is the center in geometric space.

Circle detection: Unknown radius