Lecture 6

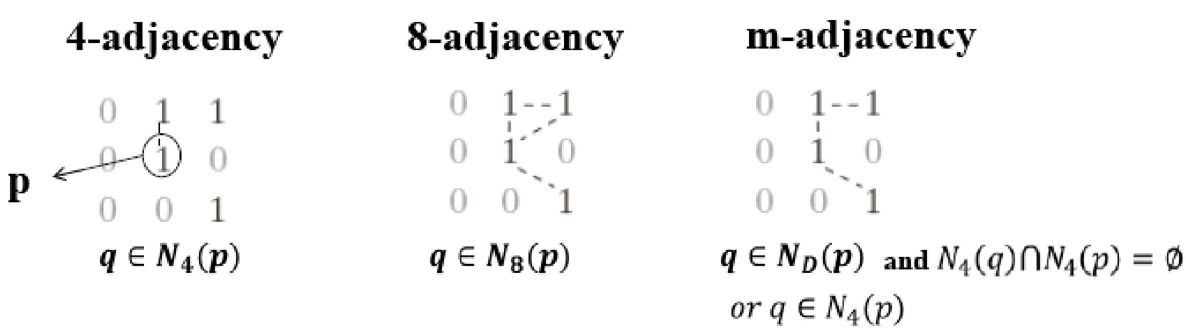
Three Types of Adjacency (cont'd)

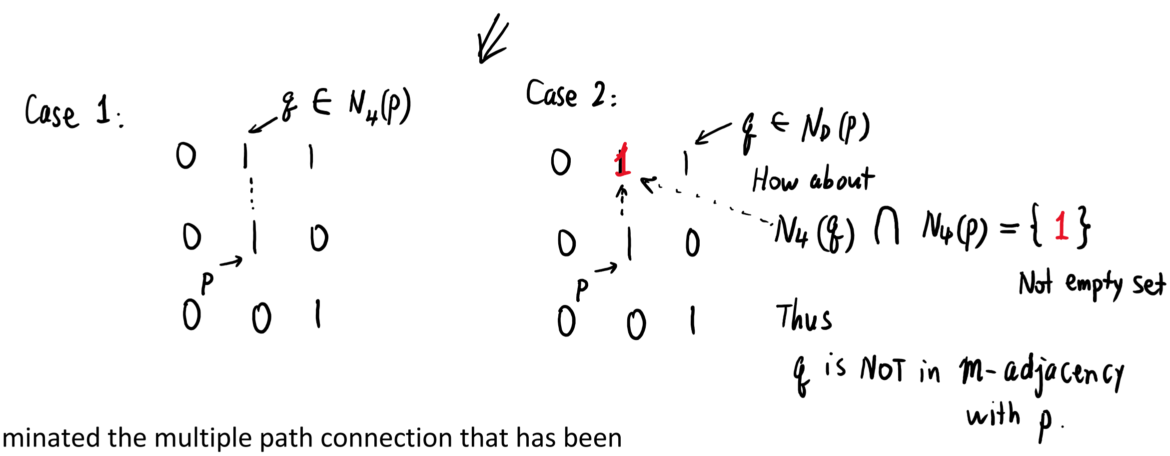
4-adjacency
–Two pixels p and q with values from V are 4-adjacent if q is in the set $N4(p)$.

•8-adjacency
–Two pixels p and q with values from V are 8-adjacent if q is in the set $N8(p)$.

•m-adjacency (mixed adjacency).

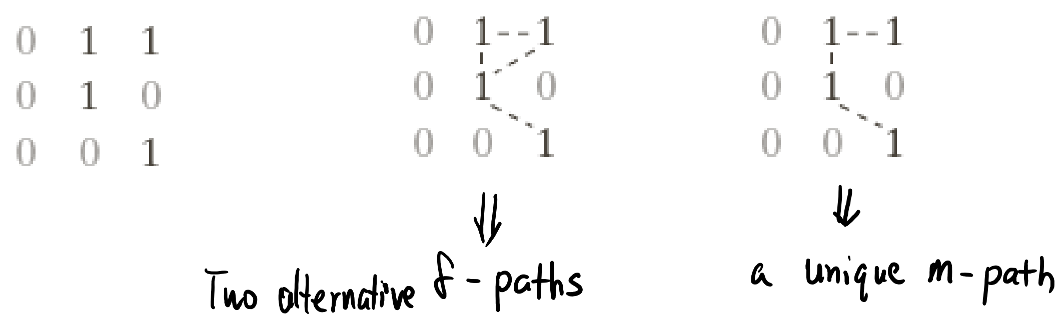
Let V be the set of intensity values used to define adjacency.





m-adjacency has eliminated the multiple path connection that has been generated by the 8-adjacency.

We can specify 4-, 8- or m-paths depending on the type of adjacency specified.



Region and Boundary

•If R happens to be an entire image, then its boundary is defined as the set of pixels in the first and last rows and columns in the image.

•This extra definition is required

Digital Path
•A digital path (or curve) from pixel p with coordinate (x,y) to pixel q with coordinate (s,t) is a sequence of distinct pixels with coordinates $(x0,y0),(x1,y1),\ldots,(xn,yn)$ where $(x0,y0) = (x,y)$ and $(xn,yn) = (s,t)$ and pixels (xi,yi) and $(xi-1,yi-1)$ are adjacent for $1 \le i \le n$.

•n is the length of the path.

$D4\ (p,q) = |\ x - s\ | + |\ y - t\ |$

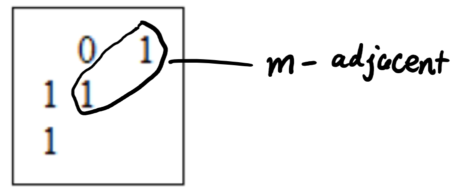
$$D_8(p,q) = \max(|x-s|,|y-t|)$$

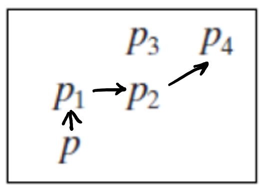
Dm distance is defined as the shortest m-path between the points.

- **Case2:** If p_1 =1 and p_3 = 0

  now, p_2 *and p will no longer be adjacent (see m-adjacency definition)*

  then, the length of the shortest path will be 3 (p, p_1, p_2, p_4)





Mathematical Tools

De-Noising

Assumption: Noise is uncorrelated to image and has zero mean.

Random Variable

$x_1, x_2, \cdots, x_n$

Sample Mean : $\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$

↓

Another random variable if $x_1, x_2, \cdots, x_n$ are values taken by underlying random variables $X_1, X_2, \cdots, X_n$

having the same distribution with the same mean $\bar{X}$

Define Sample Mean $\hat{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$

```
>> sample_size = 10;
>>  run = 100000;
>> Xavg = zeros(1, run);
>> for i = 1: run
       X = randn(1, sample_size);
       Xavg(i) = mean(X);
   end
>> mean(Xavg)
ans =
  9.4576e-04

>> histogram(Xavg)
>> doc randn
>> var(Xavg)
ans =
   0.0999
```