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# Image Classification Pre-Processing

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# Overview

- Radiometry
  - Sensor effect
  - Atmospheric effects
- Geometry
  - Terrain effects
  - Conversion from sensor to real world coordinates
- Masking of e.g. clouds, snow or steep terrain
- Merging of heterogeneous data
  - co-registration
  - resolution sampling
  - gap filling
  - mosaicking

# Radiometric Corrections

Why? Radiometric corrections may be necessary due to:

- Variations in the scene illumination & viewing geometry
- Atmospheric conditions
- Sensor noise and response (local or global)
- Systematic striping or banding
- Dropped lines



# Radiometric Corrections

## Atmospheric attenuation

- absolute radiometric correction
  - complicated, since the atmosphere is not homogenous.
- Relative radiometric correction
  - Single image normalization using histogram adjustment.
  - Multi-date image normalization using regression.

## Topographic attenuation

- Slope and aspect

# Geometric Corrections

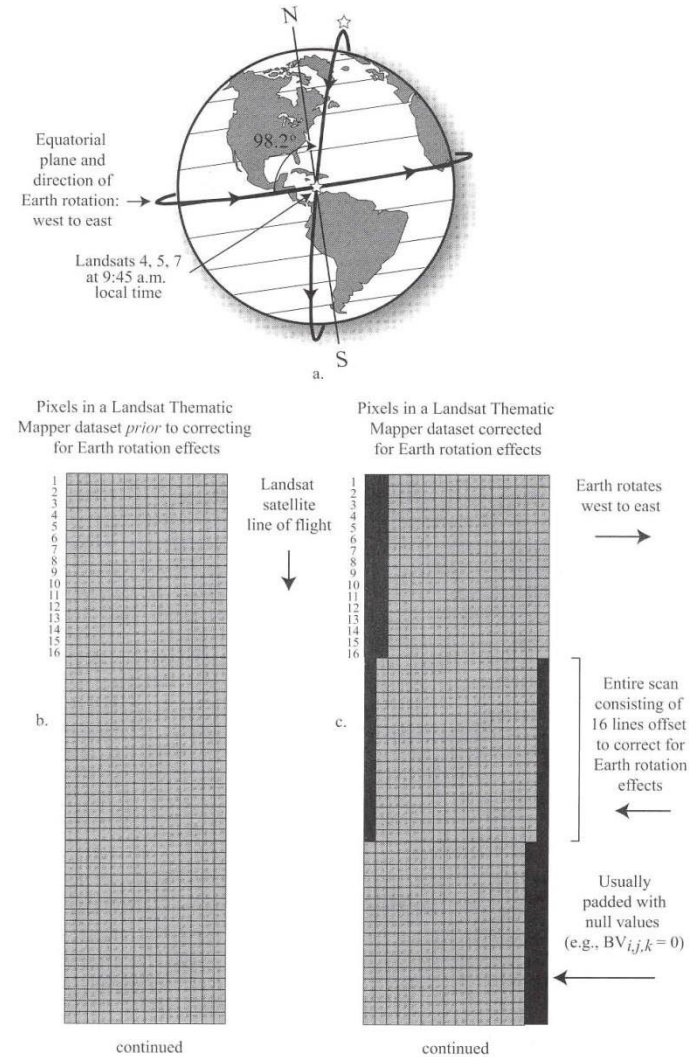
## Why geometric corrections?

### Systematic distortions

Can be corrected through analysis of sensor characteristics and ephemeris data.

### Non-systematic distortions

Can only be corrected through the use of Ground Control Points (GCPs).





# Masking

## Why Masking?

Presence of Clouds and & Cloud shadows -> obstruction of ground reflectance

Steep terrain - > Creating effect like layover and foreshortening in SAR or shadows in optical images





# Merging Data

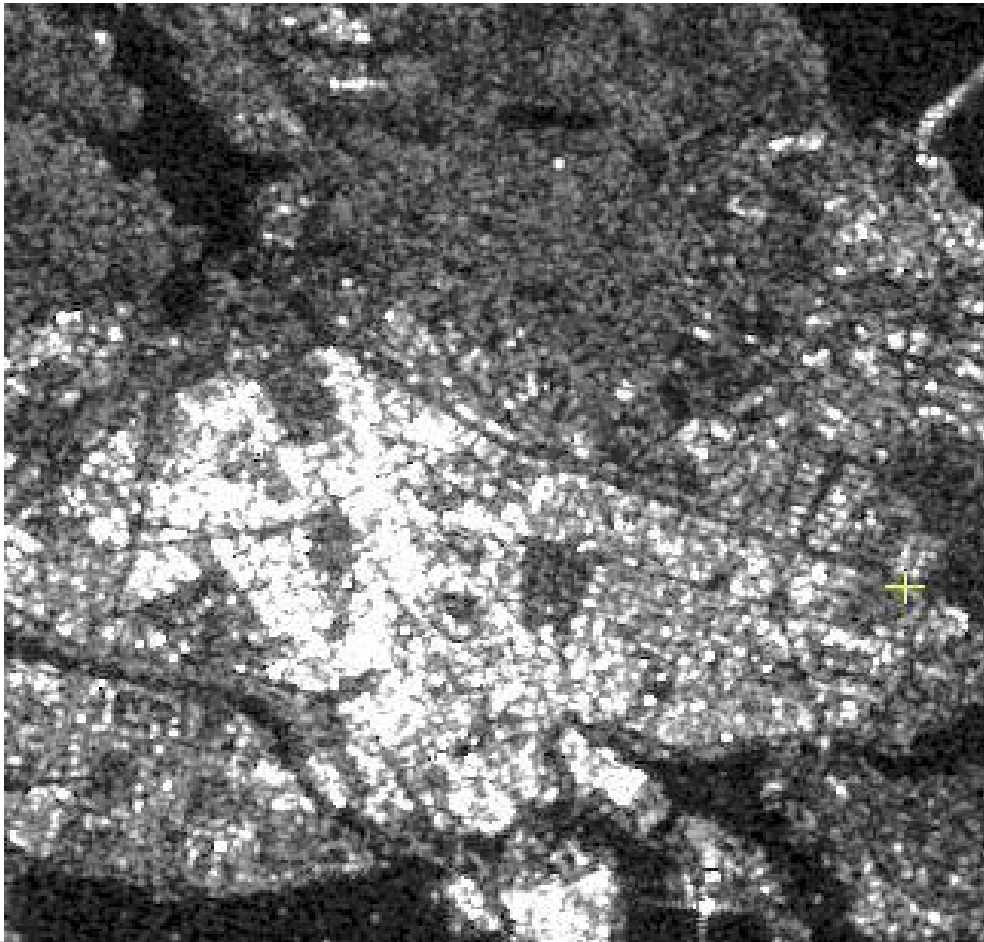
## Image to Map Registration





# Merging Data

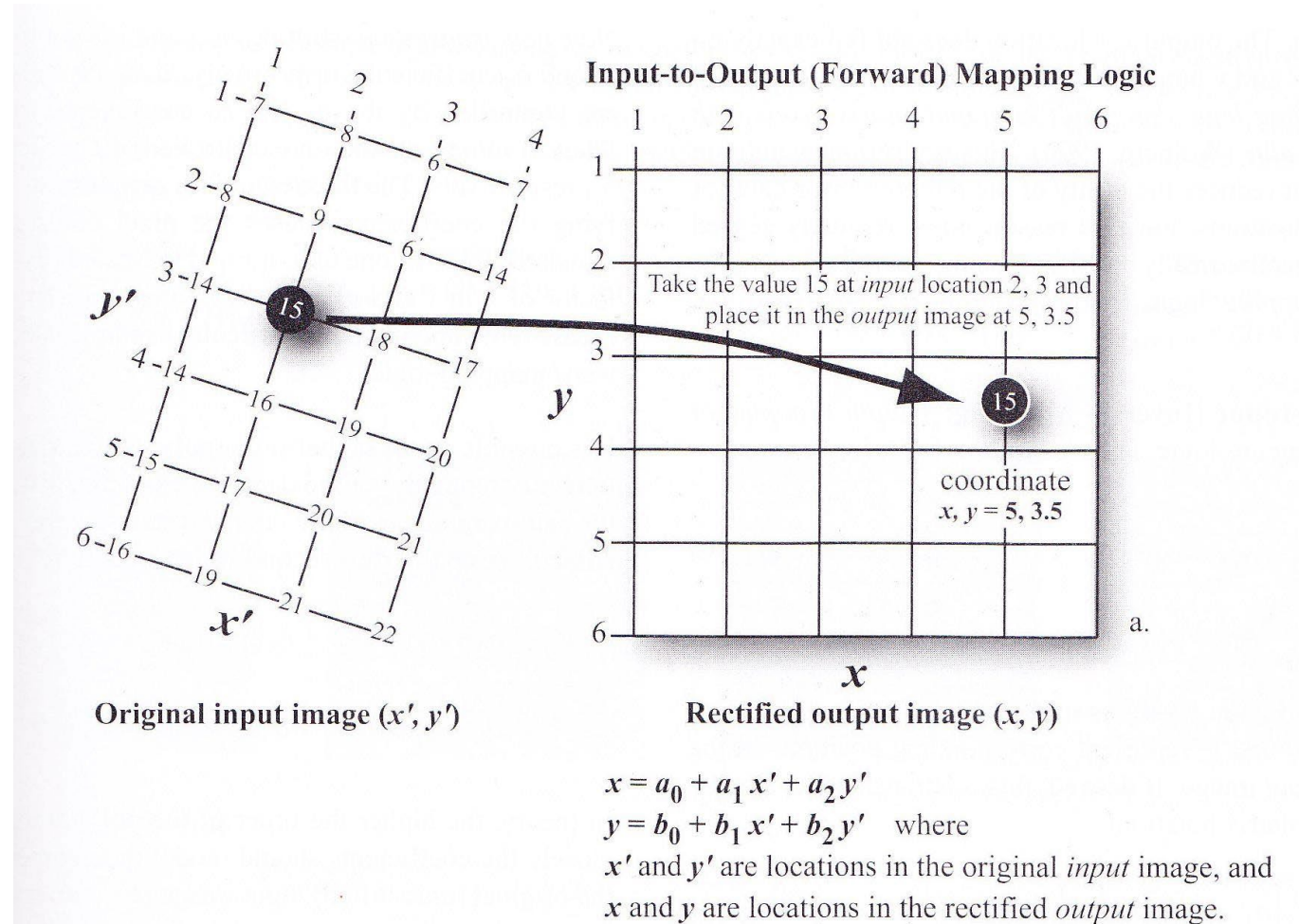
## Image to Image Registration





# Merging Data

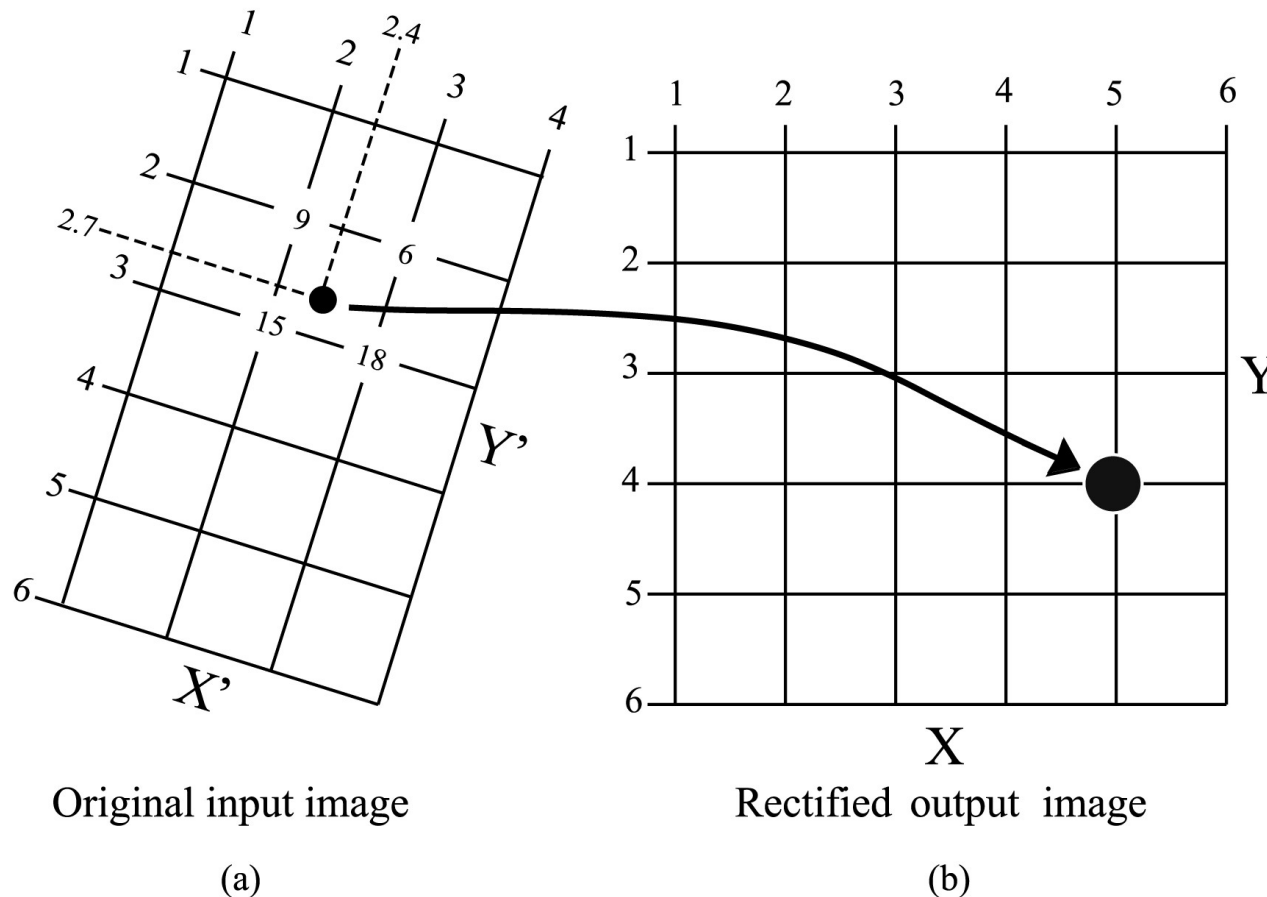
## Resampling



# Merging Data

## Resampling - Nearest Neighbor

The value closest to the predicted  $x'$ ,  $y'$  coordinate is assigned to the output  $x, y$  coordinate.



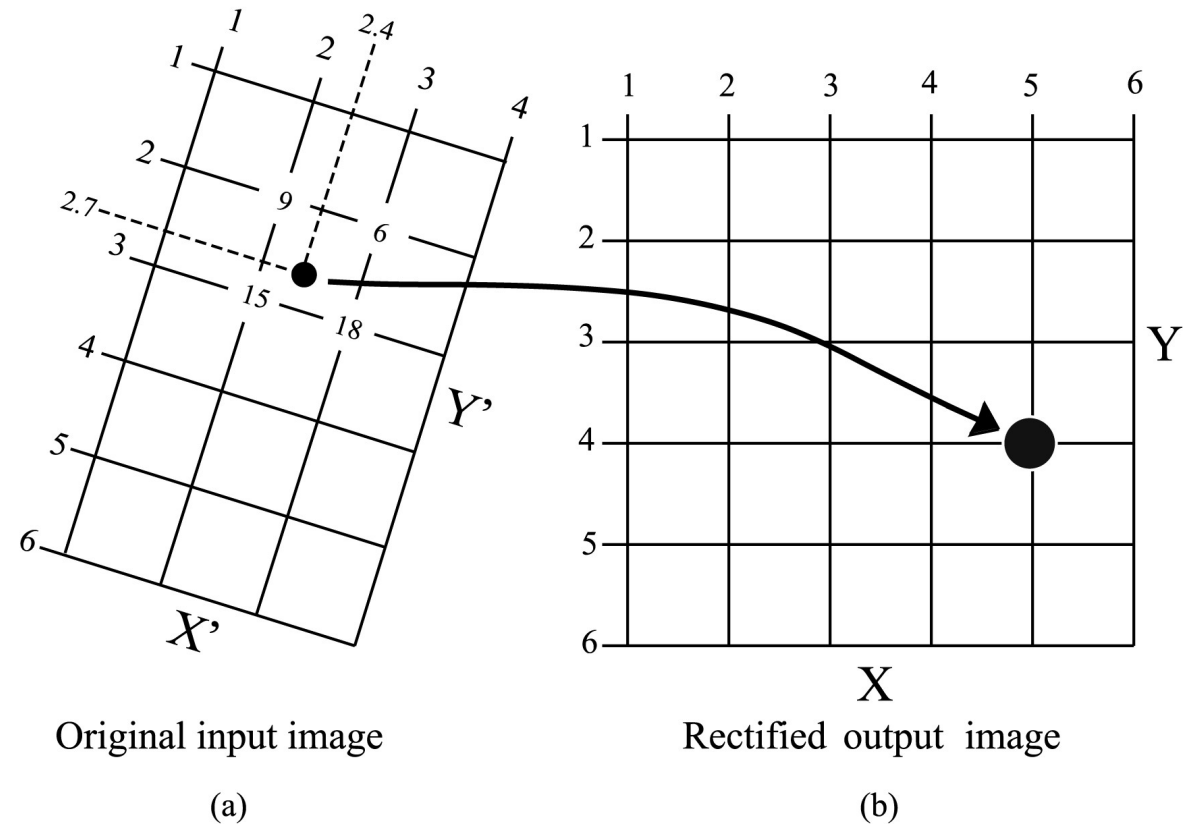


# Merging Data

## Resampling – Bilinear Interpolation

$$BV_{wt} = \frac{\sum_{k=1}^4 \frac{Z_k}{D_k^2}}{\sum_{k=1}^4 \frac{1}{D_k^2}}$$

$Z_k$  are the surrounding four data point values, and  $D_k^2$  are the distances squared from the point in question  $(x', y')$  to the these data points.

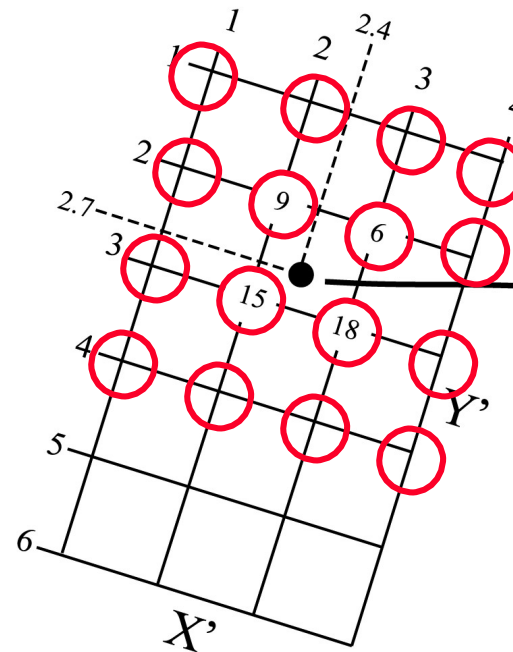


# Merging Data

## Resampling - Cubic Convolution

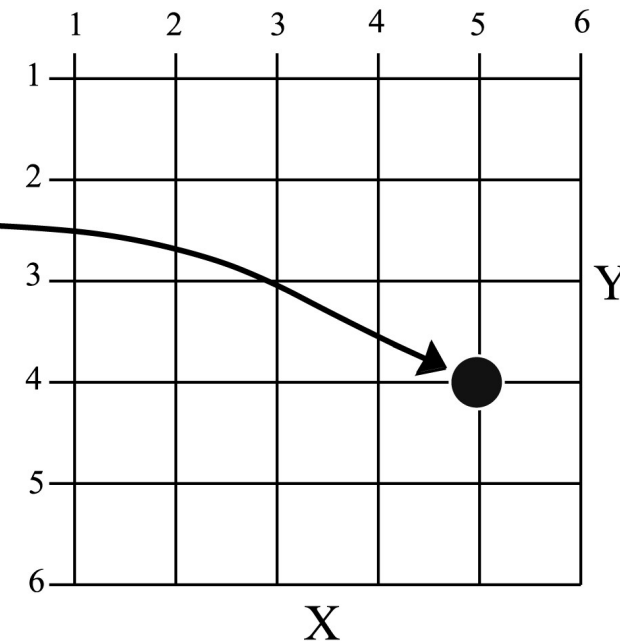
$$BV_{wt} = \frac{\sum_{k=1}^{16} \frac{Z_k}{D_k^2}}{\sum_{k=1}^{16} \frac{1}{D_k^2}}$$

$Z_k$  are the surrounding data point values, and  $D_k^2$  are the distances squared from the point in question ( $x', y'$ ) to the these data points.



Original input image

(a)

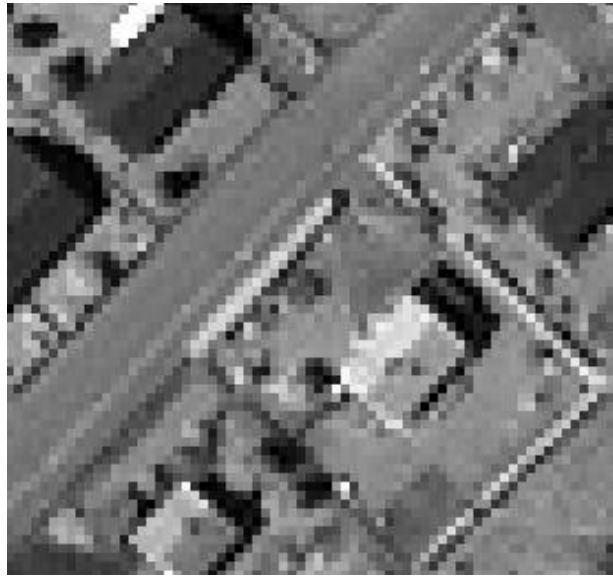


Rectified output image

(b)



# Merging Data



Nearest Neighbor



Bilinear



Cubic Convolution

# Summary

Correct radiometry to make imagery from different times or spatial locations comparable

Correct geometric errors due to terrain or observation system

Resampling is necessary, whenever we change the original grid of our data. Possible reasons are:

- Co-registration of imagery from different times, sensors, spatial locations
- Adaptation of resolution