

Principal Component Analysis

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Multivariate Data

- More correlated attributes per observation, i.e., redundancy
- Describe in new feature space where variables are uncorrelated
- E.g., height and weight of persons
- [Theory \(in old pdf-file\)](#)

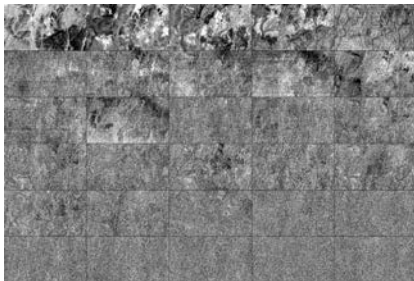
Hyperspectral Data

- AVIRIS, Airborne Visible/Infra-Red Imaging Spectrometer from NASA/JPL:
 - 224 spectral channels, 4 detectors, 370 nm to 2500 nm, channels approx. 10 nm wide,
 - flown on a NASA ER-2 airplane (a modified U2) at approx. 20 km above sea level at about 730 km/h resulting in 20 m pixels
 - (from 1998 also) low altitude data flown at 12,500 ft. on a NOAA Twin Otter aircraft resulting in 3.5 m resolution available
- ***A full spectrum for each pixel and an image for all spectra***

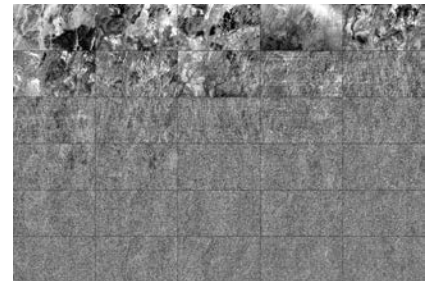
AVIRIS Data original

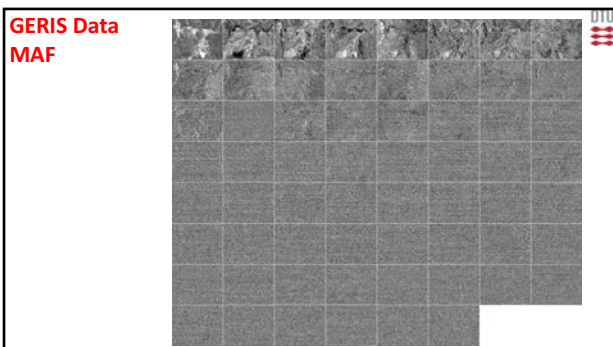
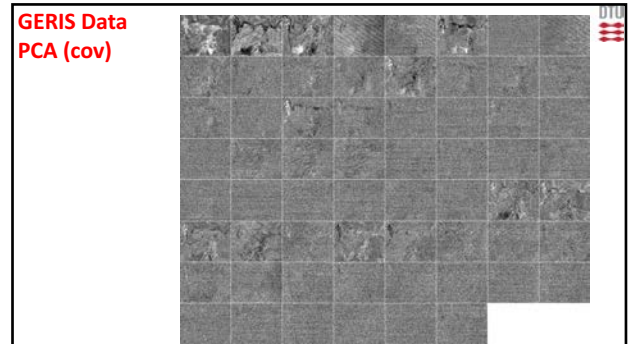
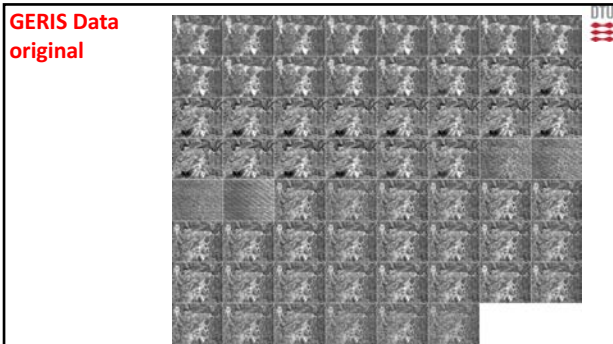


AVIRIS Data PCA (corr)



AVIRIS Data MAF





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- **Principal component analysis, PCA**
 - Scale dependence, Cov
 - Corr (zscore)
 - R-mode, Q-mode
- **Empirical orthogonal functions, EOF**
- **Singular value decomposition, SVD**
- **MAF/MNF – EPP – ICA – (M)CCA – CIA**
- **Preservation of Euclidean distance (isometry)**
- **Scree plot**
- **Variance explained**
- **Score and loadings plots**
- **Social science example**
- **Present lab/assignment and data**