

## Early Face Recognition Systems in Computer Vision

➔ Kanade *feature-based* face recognition (1973!)  
(first complete automated system)

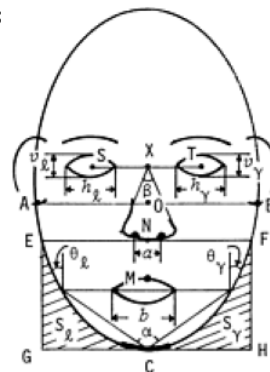
Introduction to Principal Components Analysis

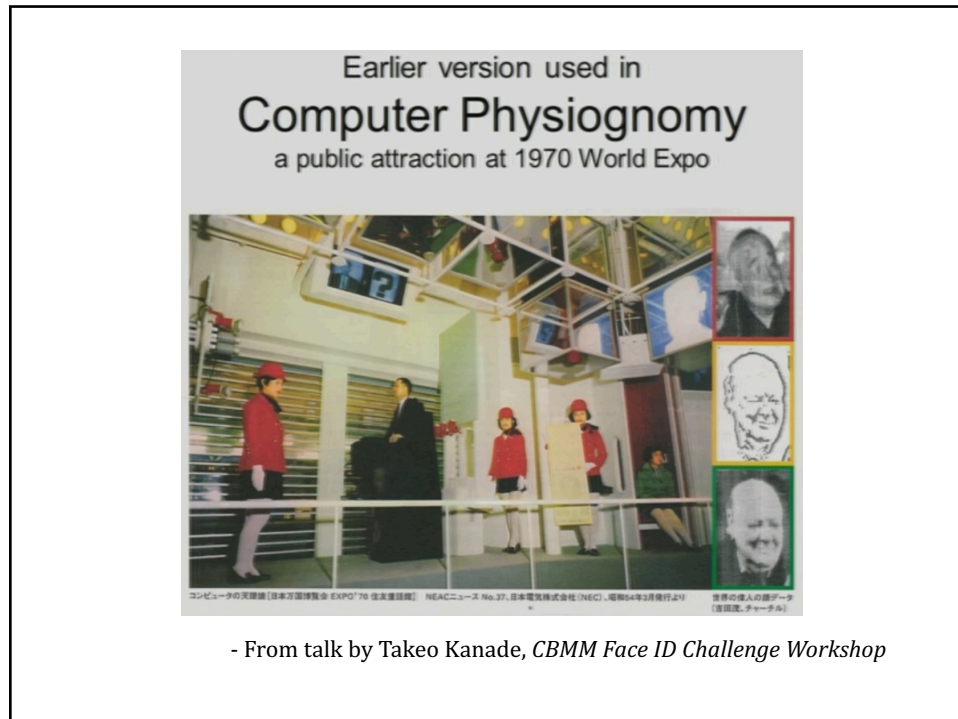
*Eigenfaces* method for face recognition  
(Turk & Pentland, 1991)

## It all began with Takeo Kanade (1973)...

PhD thesis, *Picture Processing System by Computer Complex and Recognition of Human Faces*

- Special purpose methods to locate eyes, nose, mouth, boundaries of face
- ~ 40 geometric features, e.g. ratios of distances and angles between features





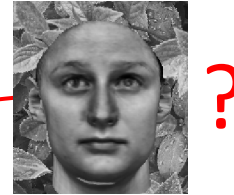
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## Goal of Principal Components Analysis (PCA)

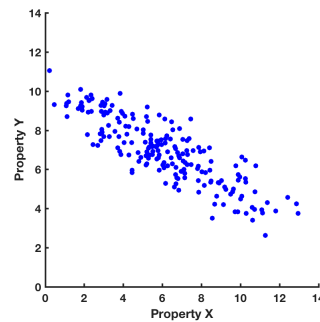
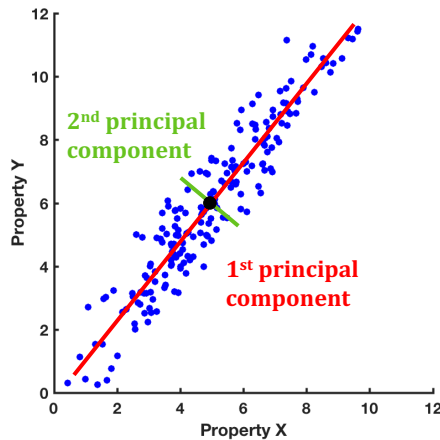


- Compact representation of face images
- Captures variation across face images in database
- Removes redundancy inherent in face images



Face Database from the Max Planck Institute

## Principal Components Analysis (2D data)



Mark location of average & draw the two principal components

**1<sup>st</sup> principal component:** direction of largest variance

**2<sup>nd</sup> principal component:** direction of second largest variance

