Principal Component Analysis

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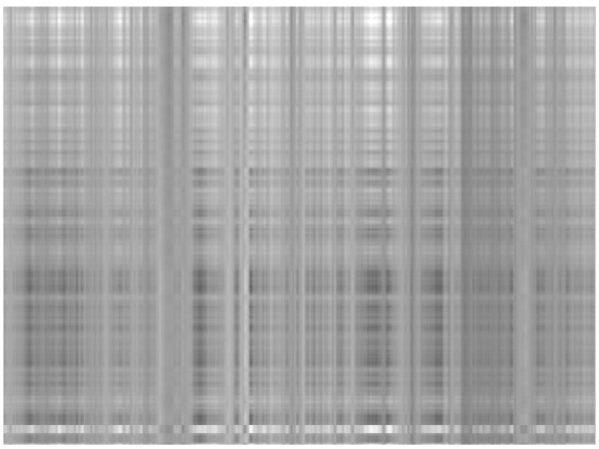
Original microstructure: Normalised carbon steel, under reflected light microscope. Size of the grey scale image 536 x 800.

Fig: microstructure of normalised carbon steel*

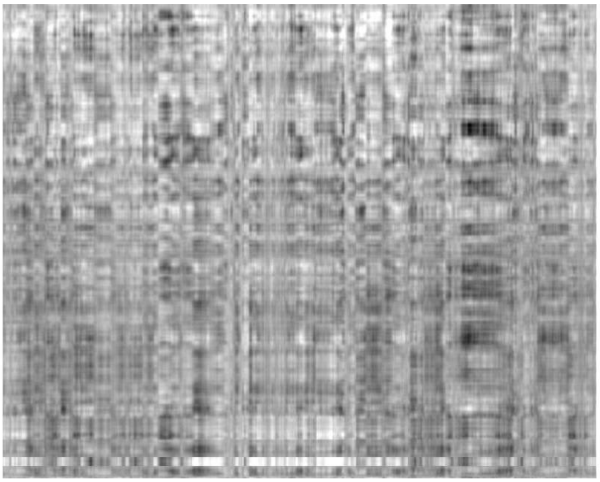
*source: https://www.doitpoms.ac.uk/miclib/full_record.php?id=213

Reconstruction using Principal component analysis:

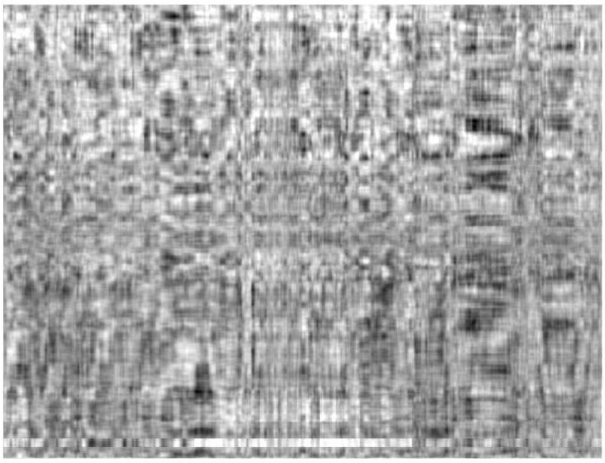
- Using 1 component:



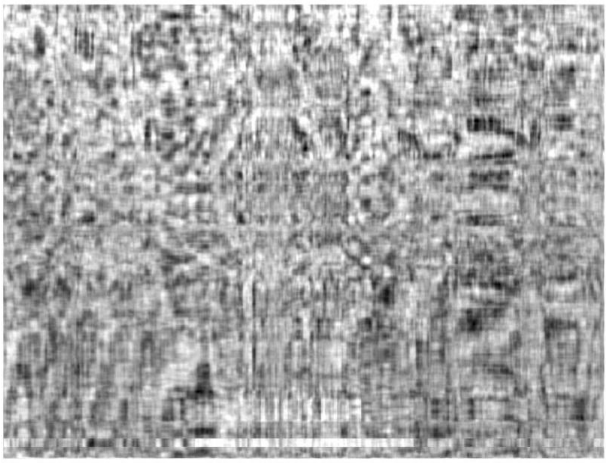
- Using 5 components:



- Using 10 components:



- Using 15 components:



Pareto plot: for the microstructure using all the components (536):

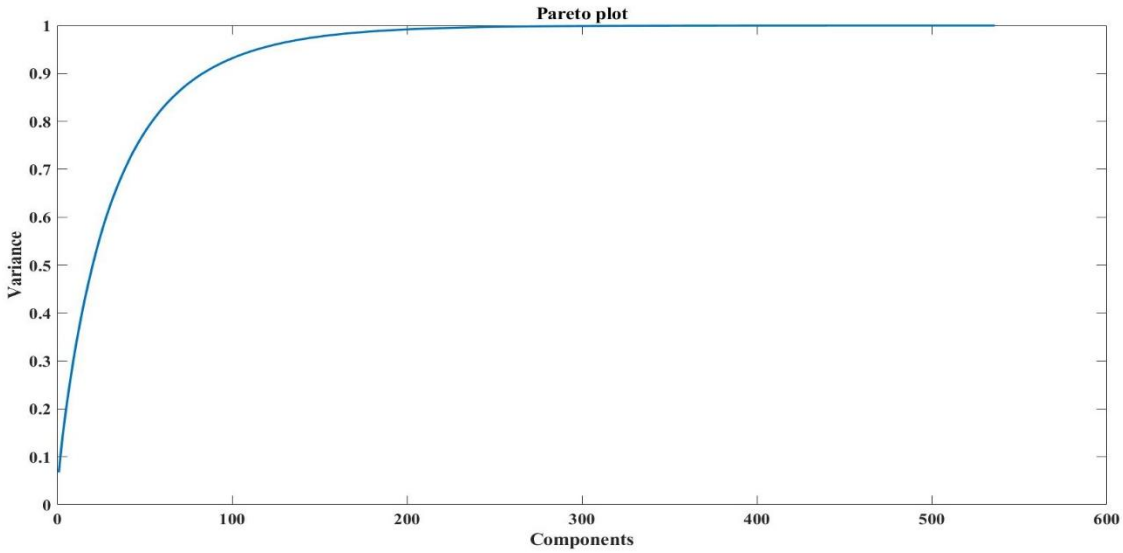


Fig: Pareto plot

Scree Plot until 95% variance in original data:

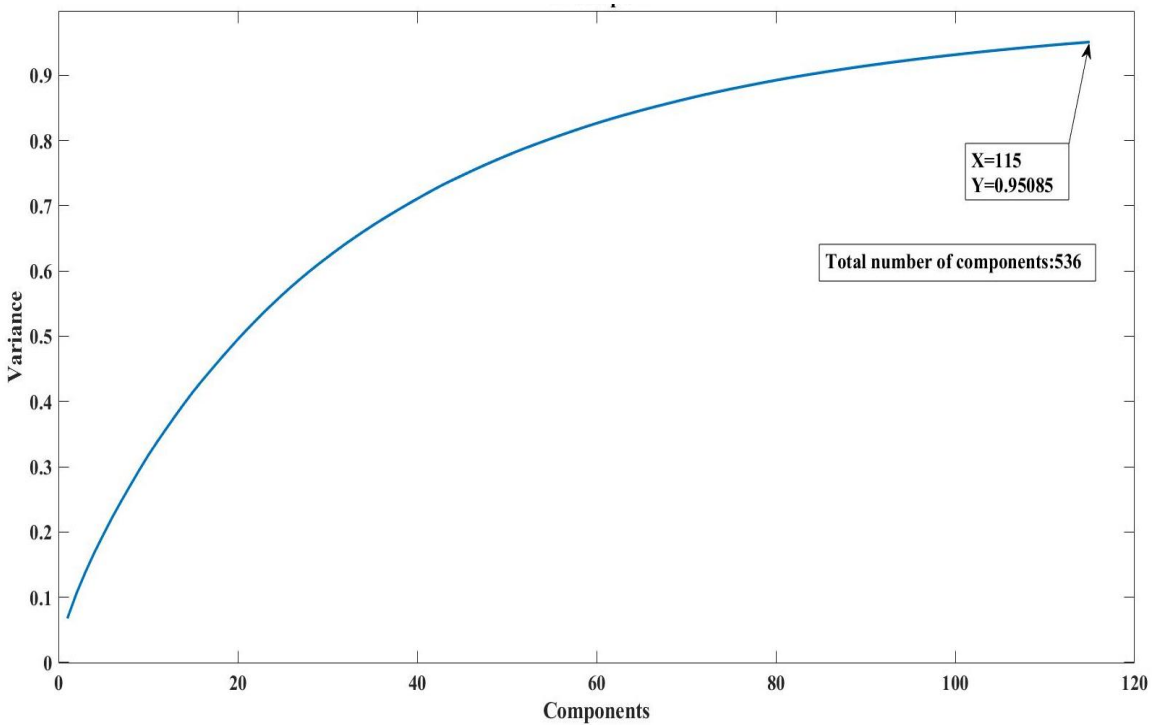


Fig: Scree plot showing number of components required for capturing 95% variance.

Hence the number of components required to capture 95% variance in original data is 115 components. The captured variance as can be seen from the above plot is around 95.085%.

Image reconstruction using 115 components:

Fig: Plot reconstruction using 115 components.

From the Pareto plot we can see that almost 99.99 % percent variance can be achieved by reconstructing using only around 247 components out of 536 components in total. Using 115 components we get 95 % variance.