Feature Extraction

- Feature Extraction depends on the what sort of data that is handled to solve the related task
- If the our data is given in 1D format, we cannot apply the feature extraction methods of 2D data.
- However, if we transform our 1D data into 2D format, we can use aforementioned feature extraction methods.
- Moreover, for text data, we have to convert the text into digital values.
- For text data, we should transform data into 1D or 2D format, which is consisting of numerical values.

2D Data

- Image Data (Face, Wheat)
- Matrix

2D Data Feature Extraction

we can calculate the following features over blocks or whole 2D data.

Traditional feature extraction methods are:

- Eigen values of PCA
- Real Parts and Imaginary Parts of FFT
- Real Parts and Imaginary Parts of DCT
- Histogram Oriented of Gradients
- Fisher Discriminant Analysis
- Bag of Words on SIFT features
- Bag of Words on SURF features
- Bag of Words on ORB features
- Bag of Words on Freak features

2D Data Feature Extraction

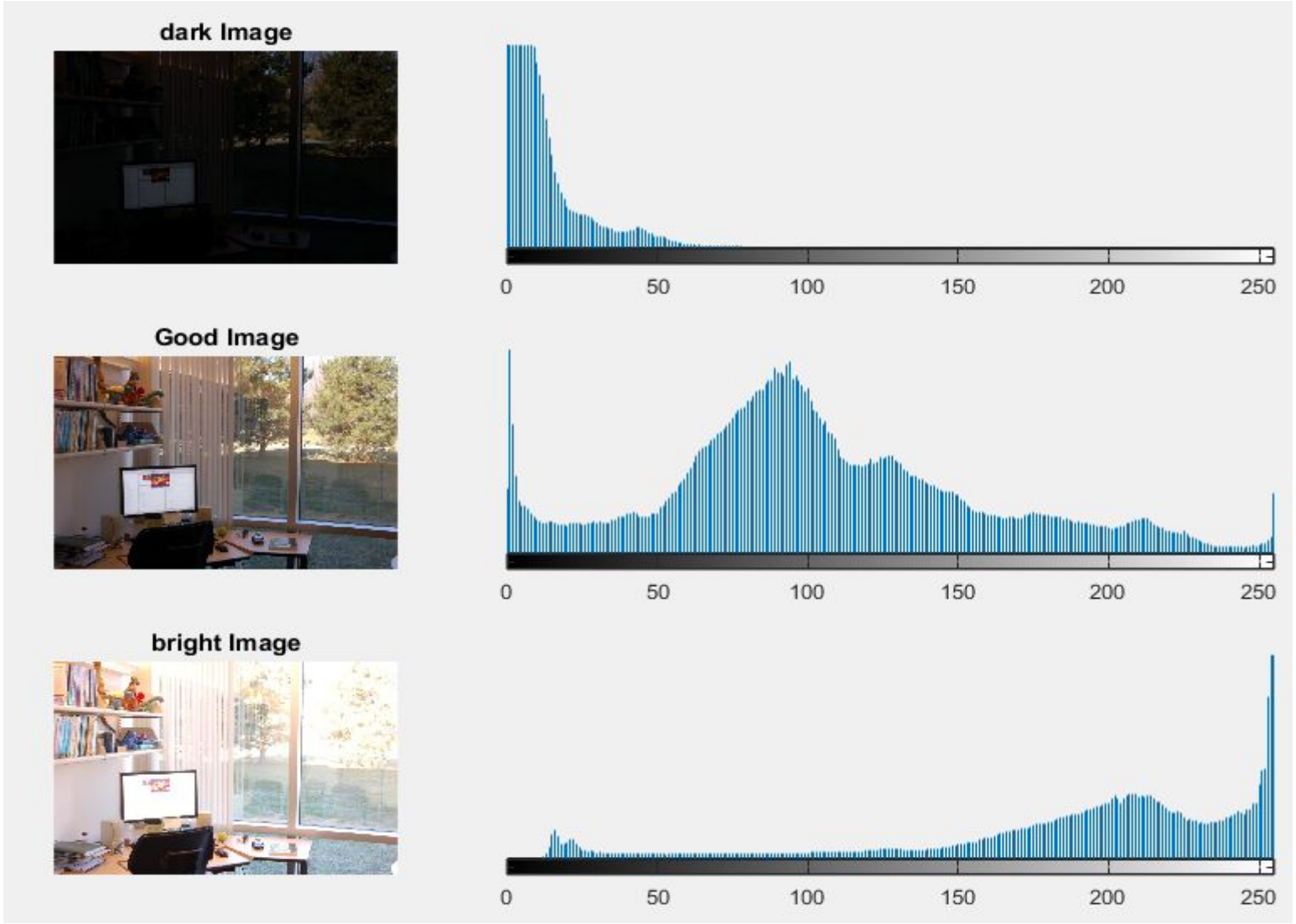
we can calculate the following features over blocks or whole 2D data.

Recent feature extraction methods are:

- Values of Fully Connection Layers of CNN (VGG, AlexNet, ResNet)
- PCA
- SVD
- LDA

2D Data

- Histogram Features



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1D Data Feature Extraction

For (1^{st} or 2^{nd} or 3^{rd} percentile) we can calculate the following features

- Mean Absolute Deviation (MAD)
- Kurtosis
- Skewness
- Median
- Hilbert Mean
- Hann Window Mean
- Mean of Exponential Moving Average
- Standard Deviation of Exponential Moving Average
- Mean of Exponential Moving Standard Deviation
- Mean of Exponential Moving Standard Deviation

1D Data Feature Extraction

For (1^{st} or 2^{nd} or 3^{rd} percentile) we can calculate the following features

Also, we can take absolute values of those features

- Autocorrelation
- Binned Entropy
- Number of peaks

1D Data

- Earthquake data
- Voice Classification
- Network Data (VPN or not VPN)

1D Data Feature Extraction

For (1^{st} or 2^{nd} or 3^{rd} percentile) we can calculate the following features.

Also, we can take absolute values of those features

- Mean
- Harmonic mean
- Geometric mean
- Standard Deviation
- Max, Min
- k-statistic
- Moments
- Imaginary and real parts of FFT
- Difference between max and min
- Mean change rate

1D Data Feature Extraction

For (1^{st} or 2^{nd} or 3^{rd} percentile) we can calculate the following features

- Mean Absolute Deviation (MAD)
- Kurtosis
- Skewness
- Median
- Hilbert Mean
- Hann Window Mean
- Mean of Exponential Moving Average
- Standard Deviation of Exponential Moving Average
- Mean of Exponential Moving Standard Deviation
- Mean of Exponential Moving Standard Deviation

1D Data Feature Extraction

For (1^{st} or 2^{nd} or 3^{rd} percentile) we can calculate the following features

Also, we can take absolute values of those features

- Autocorrelation
- Binned Entropy
- Number of peaks

Feature Selection

Feature Selection is a process using to remove the unnecessary and redundant features.

Ex. We have 4096 features that are extract from a CNN algorithm.

- We don’t know which ones of related features are meaningful or discriminative.
- Therefore, we should apply the feature selection strategy.