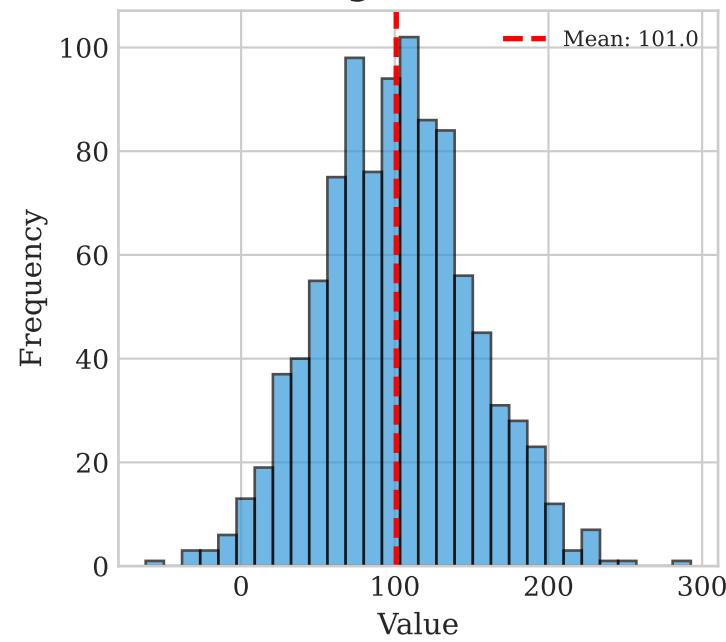
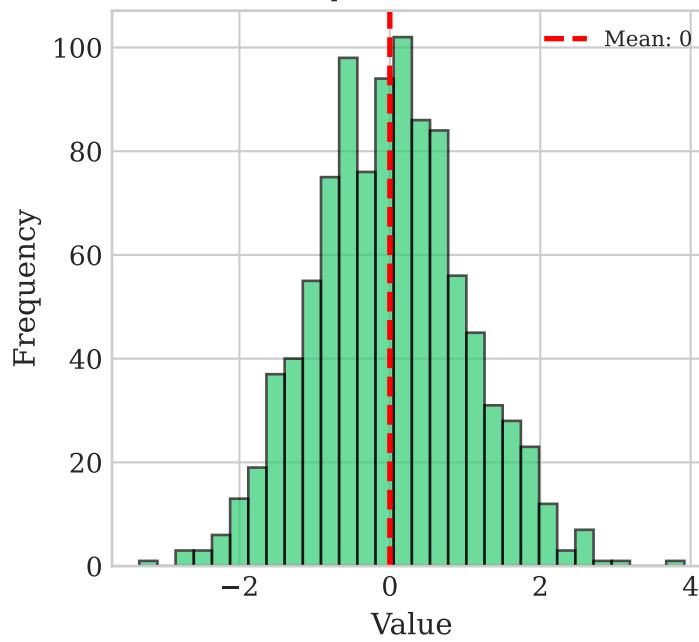


# Data Normalization and Standardization Techniques

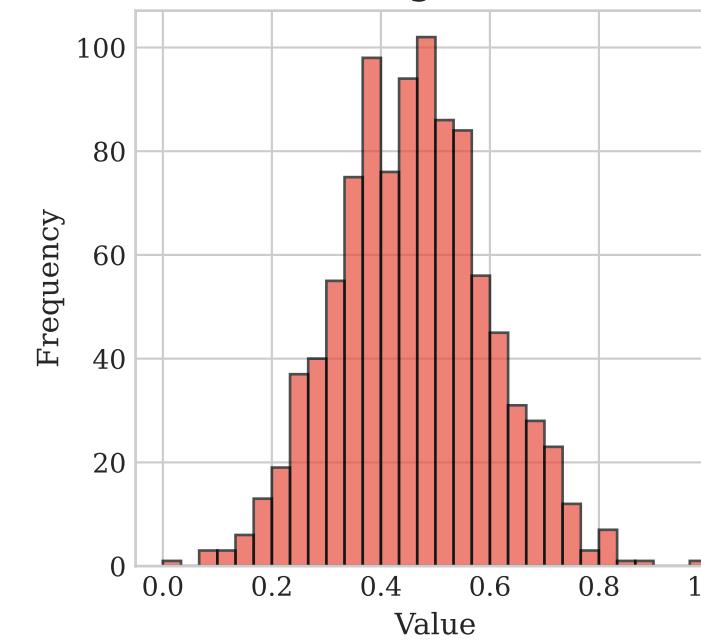
**Raw EEG Data  
(Original Scale)**



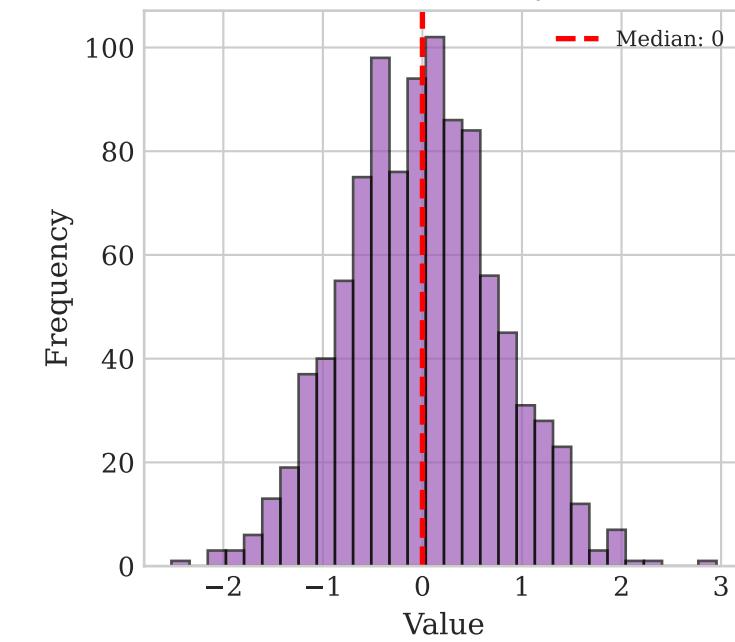
**Z-Score Normalization  
( $\mu=0, \sigma=1$ )**



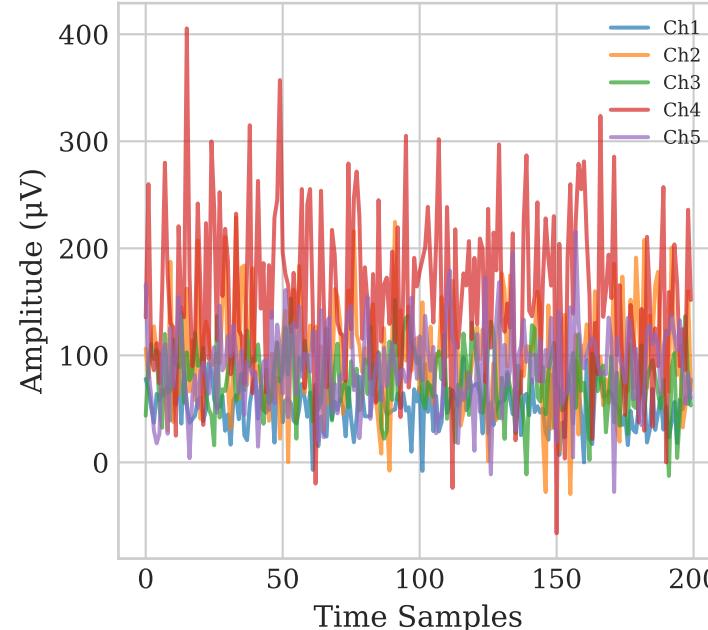
**Min-Max Normalization  
(Range: 0-1)**



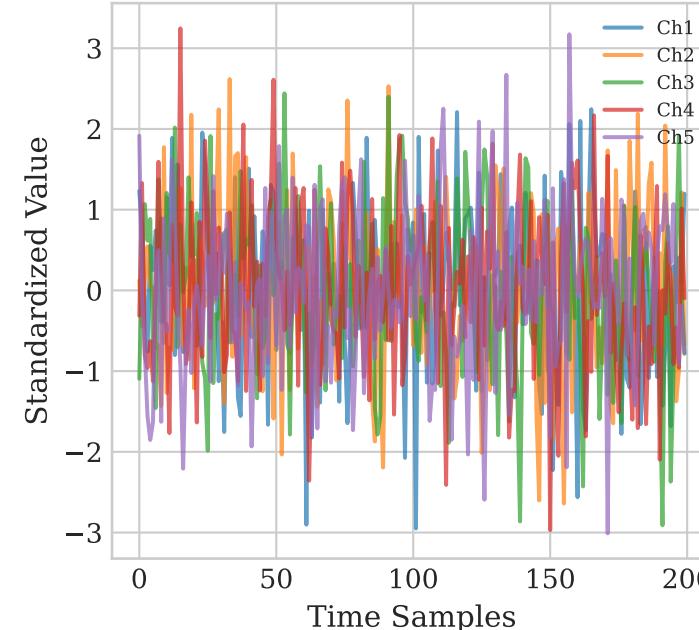
**Robust Scaling  
(Median & IQR)**



**Before: Channel Scales Vary**



**After: Channel-wise Z-Score**



**Normalization Methods Summary**

Method	Formula	Range	Use Case
Z-Score	$(x-\mu)/\sigma$	$(-\infty, +\infty)$	Normal dist.
Min-Max	$(x-\min)/(max-\min)$	$[0, 1]$	Bounded data
Robust	$(x-\text{median})/\text{IQR}$	$(-\infty, +\infty)$	Outliers
L2 Norm	$x/\ x\ _2$	$[0, 1]$	Unit vectors

**Training Convergence Impact**

