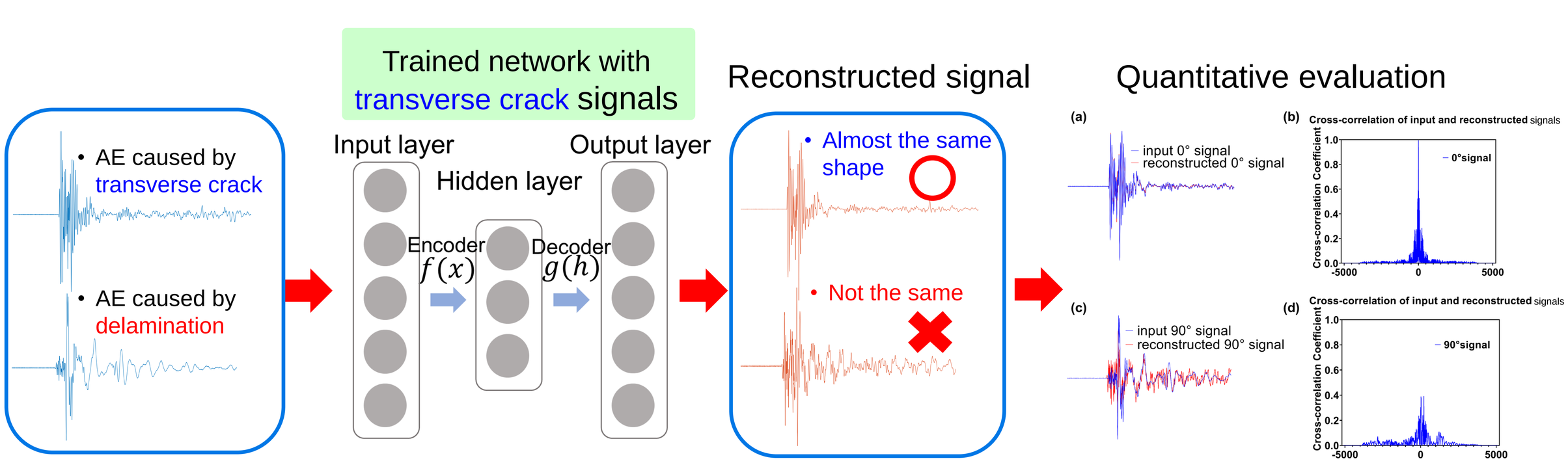
Application of Machine Learning to a Novel Analytical Method of AE Waveform Signals

Background

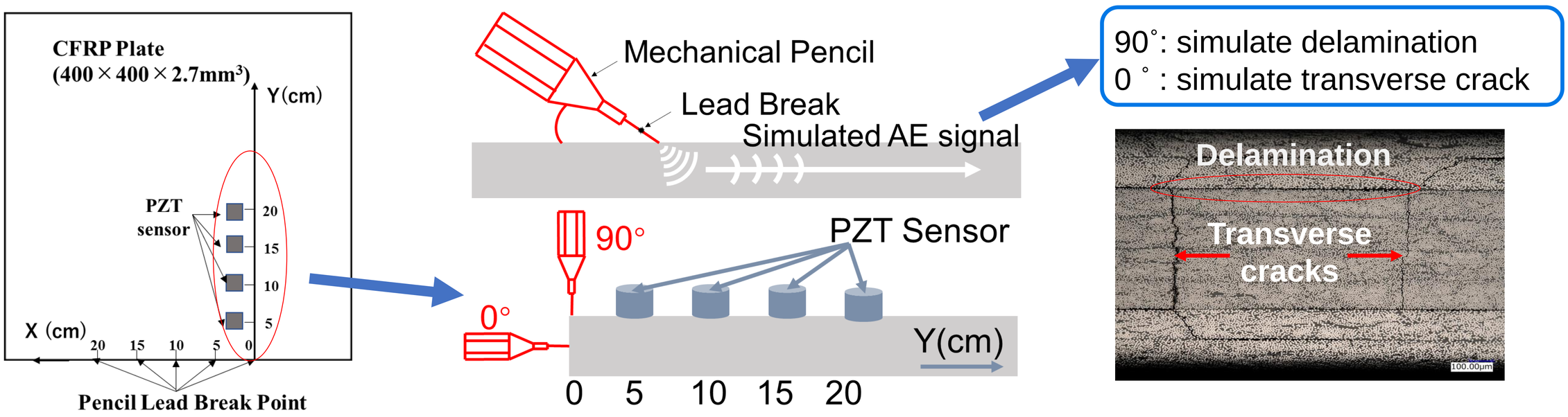
In structural health monitoring, an acoustic emission (AE) measurement is effective to detect, locate and identify damages because AE signals contain useful information on damage-occurrence mechanisms. However, mode behaviors in AE signals will change in the situation of long propagation distance. Hence, we have developed an autoencoder to identify the damage types of AE sources independent of the different propagation distances.

Autoencoder model



The results of cross-correlation coefficients indicate that the trained autoencoder-based model can identify AE signals generated by transverse crack and delamination

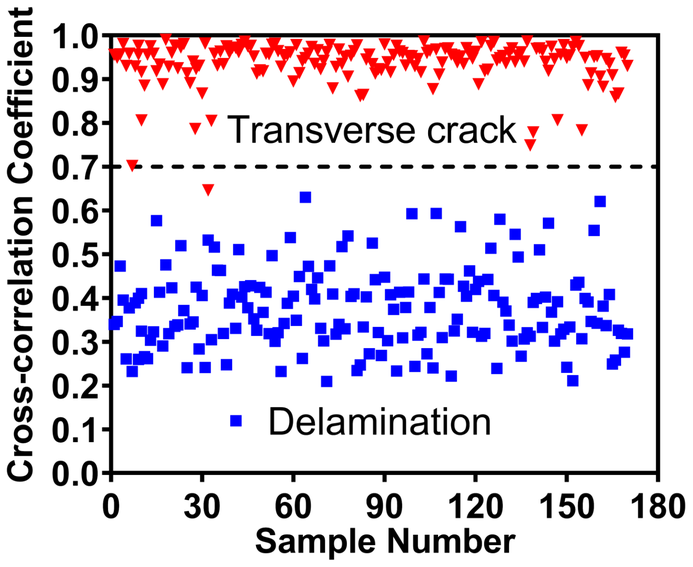
Validation Experiment



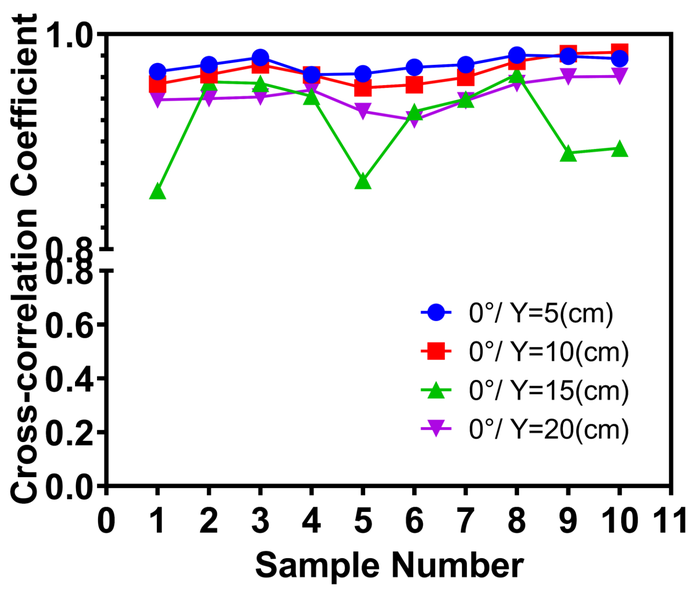
PLB test was conducted to excite two kinds of signals with 0° and 90° source orientations that simulate the AE signals generated by transverse cracks and delamination respectively.

Experimental Results

Damages classification by Cross-correlation coefficient



Cross-correlation coefficient with different propagation distance



Autoencoder-based model can identify AE signals excited by sources with different source-orientations. This classification method for AE signals is still effective even if propagation distance of Lamb wave changed.