Cavitation is a common phenomenon in fluid machinery that causes unwanted consequences, such as excessive vibration and noise, damage to material surfaces, and degradation of hydraulic performance. Given that mechanical designs to prevent cavitation are complicated and costly, cavitation detection by signal processing tools is likely the best solution to ensure the reliability of fluid machinery. Vibration/acoustic measurement and analysis is widely accepted as the effective tool in the field of diagnostics owing to its ability to obtain substantial information that reflects mechanical equipment condition and convenience of sensor arrangement. Therefore, the study aims to realize the cavitation state characterization within fluid machinery based on vibration/acoustic measurement, and the pictorial information provided by the visualization technique will serves as the validation of bubble state. The main research content would be:

- Explain the vibration/acoustic mechanism of fluid machinery under different cavitation states based on the amplitude modulation theory, and then construct the unified vibration/acoustic signal model.
- Establish the qualitative and quantitative demodulation methods to characterize the cavitation state within fluid machinery based on cyclostationarity analysis and spectral kurtosis theory.
- Realize the intelligent classification of cavitation bubble within fluid machinery based on demodulation methods, time-frequency analysis, and deep convolutional neural network.