

Phase Resolved SMOTE for Diagnosis of Image Data with Periodic Pattern of Fault

Jiwoon Han¹, Daeil Kwon¹

¹Department of Industrial Engineering, Sungkyunkwan University, Republic of Korea

This paper proposes a novel approach, phase resolved SMOTE, for diagnosis of image data with periodic patterns. When anomaly occurs within a periodic data, such as alternating current signals, irregular patterns may appear by aligning the data with respect to phase. Phase resolved SMOTE extracts the irregularities within a periodic data, and generates synthetic image data with each phase segment. Phase resolved SMOTE generates synthetic image data, containing the irregularities from early, the onset of anomaly, to late stages of the irregular pattern. The diagnosis model can learn the progression of irregularities from the early to the late stages with the synthetic data generated by Phase resolved SMOTE. A case study was conducted using partial discharge (PD) data, collected for insulation fault diagnosis of high voltage cables. Phase resolved partial discharge (PRPD) transformed the periodic PD signals into an image based on the phase of AC signals. Phase resolved SMOTE generated synthetic PRPDs using a limited dataset, consisting of the early and the late stages of the irregular patterns. The synthetic PRPDs were utilized to train a diagnosis model using their irregular patterns. Using phase resolved SMOTE, the diagnosis model learned the progression from the early to the late stages, and outperformed traditional SMOTE.