PARTIAL DISCHARGE (PD) ANALYTIC TOOLS FOR ESTER FLUID FILLED TRANSFORMERS

Partial Discharge (PD) occurs when there is a partial electrical breakdown in a weak region of a transformer's oil-paper insulation system. With the increasing penetration of ester fluid filled transformers and their eventual ageing and associated insulation deterioration, it is necessary to investigate the applicability of the existing PD data analysis tools to PD measurement of ester fluid filled transformers.

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It would be appropriate to research new techniques, which can be complementary to the existing PD analysis tools. PD measurements were conducted on experimental PD models (i.e. insulation systems) comprising solid insulation and insulating fluid (mineral oil or FR3). The phase resolved PD (PRPD) diagrams were constructed based on the measurement data. Statistical parameters were extracted from the PRPD diagrams as features to characterise a particular type of PD source.

RECORD MEASUREMENT DATA

It was found that the PRPD diagram obtained from an insulation system is mainly decided by the type of PD source (e.g. internal discharge, discharge in oil, discharge due to metal pieces etc.) inside the insulation system. As such, PD source classification methodologies and algorithms developed for mineral oil filled transformer can be extended to FR3 filled transformer.

Accordingly, a suite of signal processing algorithms for effectively extracting PD data from noise were developed. Pattern recognition algorithms for PD source classification were also developed. For PD measurement of a transformer, it is necessary to record measurement data over a sufficient period. However, a data acquisition system has a limitation in the depth of its memory. Thus, a compressive sensing method was implemented to compress PD data before storing the data in the measurement system. This method provides a form of compression for PD data while preserving PD data's original characteristics. The PD analytic tools is integrated into a transformer health management platform as shown in Figure 1.
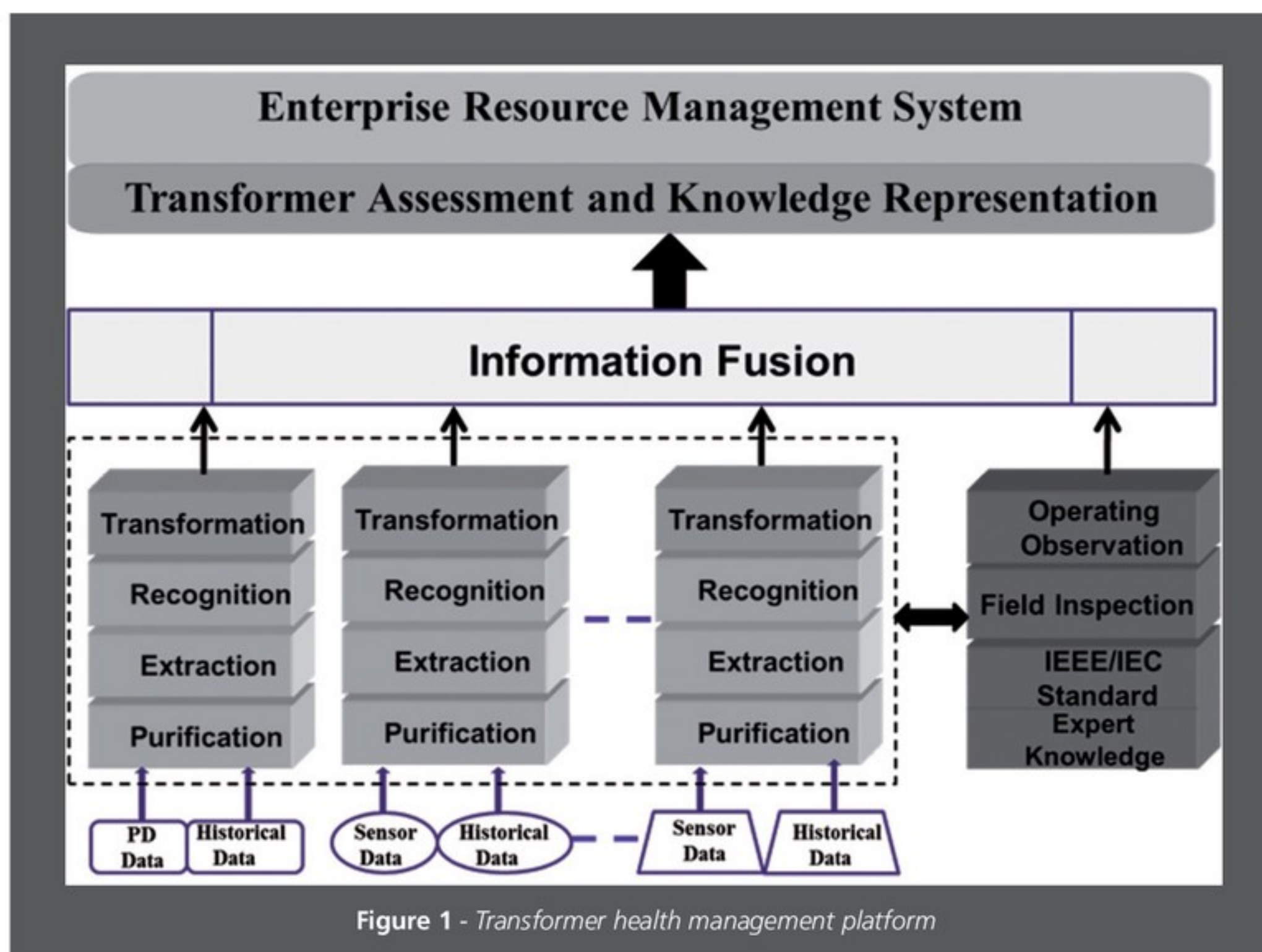
Figure 1 - *Transformer health management platform*