An End-to-end Piping and Instrumentation Diagram Information Recognition System

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Abstract : Piping and instrumentation diagram (P&ID) is an essential design drawing describing the interconnection of process equipment and the instrumentation installed to control the process. P&IDs are modified and managed throughout a whole life cycle of a process plant. For the ease of data transfer, P&IDs are generally handed over from a design company to an engineering company as portable document format (PDF) which is hard to be modified. Therefore, engineering companies have to deploy a great deal of time and human resources only for manually converting P&ID images into a computer aided design (CAD) file format. To reduce the inefficiency of the P&ID conversion, various symbols and texts in P&ID images should be automatically recognized. However, recognizing information in P&ID images is not an easy task. A P&ID image usually contains hundreds of symbol and text objects. Most objects are pretty small compared to the size of a whole image and are densely packed together. Traditional recognition methods based on geometrical features are not capable enough to recognize every elements of a P&ID image. To overcome these difficulties, state-of-the-art deep learning models, RetinaNet and connectionist text proposal network (CTPN) were used to build a system for recognizing symbols and texts in a P&ID image. Using the RetinaNet and the CTPN model carefully modified and tuned for P&ID image dataset, the developed system recognizes texts, equipment symbols, piping symbols and instrumentation symbols from an input P&ID image and save the recognition results as the pre-defined extensible markup language format. In the test using a commercial P&ID image, the P&ID information recognition system correctly recognized 97% of the symbols and 81.4% of the texts.

Keywords : object recognition system, P&ID, symbol recognition, text recognition

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