World Academy of Science, Engineering and Technology
International Journal of Educational and Pedagogical Sciences
Vol:16, No:06, 2022

A U-Net Based Architecture for Fast and Accurate Diagram Extraction

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Abstract : In the context of educational data mining, the use case of extracting information from images containing both text and diagrams is of high importance. Hence, document analysis requires the extraction of diagrams from such images and processes the text and diagrams separately. To the author's best knowledge, none among plenty of approaches for extracting tables, figures, etc., suffice the need for real-time processing with high accuracy as needed in multiple applications. In the education domain, diagrams can be of varied characteristics viz. line-based i.e. geometric diagrams, chemical bonds, mathematical formulas, etc. There are two broad categories of approaches that try to solve similar problems viz. traditional computer vision based approaches and deep learning approaches. The traditional computer vision based approaches mainly leverage connected components and distance transform based processing and hence perform well in very limited scenarios. The existing deep learning approaches either leverage YOLO or faster-RCNN architectures. These approaches suffer from a performance-accuracy tradeoff. This paper proposes a U-Net based architecture that formulates the diagram extraction as a segmentation problem. The proposed method provides similar accuracy with a much faster extraction time as compared to the mentioned state-of-the-art approaches. Further, the segmentation mask in this approach allows the extraction of diagrams of irregular shapes.

Keywords : computer vision, deep-learning, educational data mining, faster-RCNN, figure extraction, image segmentation, real-time document analysis, text extraction, U-Net, YOLO
Conference Title : ICEDM 2022 : International Conference on Educational Data Mining
Conference Location : Copenhagen, Denmark
Conference Dates : June 09-10, 2022