Recognition of expiration dates on product packages using fully convolutional networks

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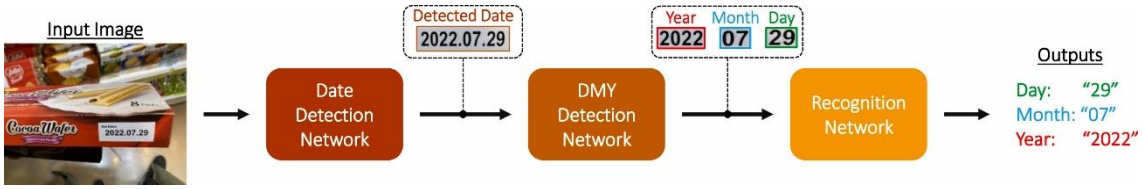
HIGHLIGHTS:

- A generalized framework for detecting and understanding expiration dates.
- A new DMY (Day, Month, Year) detection network for understanding expiration dates.

Deep learning-based optical character recognition (OCR) is one of the most widely used methods. The recognition of expiration dates is another specific task in industrial applications. There have been many studies dealing with several challenges in recognizing the expiration dates due to the lack of universal standards for the expiration dates. The main reason arises from the decision made by each manufacturer relating to the properties of the expiration date, such as date format and font types, etc. Therefore, expiration dates are printed in many variations, which causes many problems with reading and understanding. For instance, various font types cause expiration dates to appear in different thicknesses, or the dot-matrix font, widely used for expiration dates, can have a large space between its dots. Hence in total there are 13 different types of dates order we can have . Printer machines can occasionally cause some printing issues in the production line. These cases make it challenging to identify the day, month, and year components of an expiration date.



The system runs in the following order: Given an input image, the date detection network detects the near-horizontal dates and extracts their regions from the entire input image. Here, three additional new classes are defined (due mark, production mark, and code mark) along with the date class, unlike other methods, to obtain a more robust detection performance. Then, the DMY detection network identifies and extracts the day, month, and year components from the detected date regions. Here, it acts as a CNN-based date parser. Next, the recognition network recognizes the characters of the day, month, and year components. After recognizing the characters, the appropriate date is selected as the expiration date. Eventually, the framework can distinguish 13 different expiration date formats and understand the meaning of expiration dates by determining the day, month, and year. Additionally, due to the absence of a publicly available expiration date dataset, a novel dataset collection, ExpDate, has been created, consisting of six different datasets for training and evaluating the networks in the proposed framework.

The DMY detection network is proposed as a date parser, which detects and classifies day, month, and year components to help understand the meaning of expiration dates.

3. Methods

Date detection: . The date detection network consists of a feature extractor, a feature pyramid network (FPN). . It also generates a center-ness score and regression values that denote left, top, right, and bottom distances from the center point to the border of a bounding box. It is worth noting that the center-ness layer is placed parallel to the regression layer in shared heads, which gives better detection performance .Three more classes are defined, such as due mark, production mark, and code mark, in addition to date class.

DMY detection: DMY detection network is proposed for distinguishing the day, month, and year components of the expiration date.The DMY detection network consists of a feature extractor and shared heads. The architecture of the DMY detection network is shown in Fig. 2. The network output comprises classification, regression, and center-ness layers. The classification layer makes predictions for three classes: day, month, and year for each feature map point. The regression layer predicts the distances from the center point to each border of the bounding box per feature map point. The center-ness layer predicts the center-ness scores for each feature map point.

Recognition network: To recognize the characters of the detected day, month, and year regions, decoupled attention network (DAN) (Wang et al., 2020) is adapted, originally developed for scene and handwritten text recognition. The recognition network is fine-tuned with it. In the inference, the fine-tuned network recognizes the characters in the detected day, month, and year regions. After recognition, the result is checked for the DDMMYY format to see if it is actually in the YYMMDD format.

4. Datasets: Novel datasets were created for each network in the proposed framework. The collection of these datasets is called “ExpDate”. For the date detection network, a novel expiration date dataset, Products-Real, was collected by capturing 1767 real-world expiration date images from food, beverage, and medicine products. It is split into training and test sets consisting of 1102 and 665 images. Additionally, around 12k product images with synthetic dates were generated to obtain various date samples in training. This synthetic dataset is called as Products-Synth.

TIMELINE:

- Research and Familiarization
- Data Collection
- Data Preprocessing
- Model Design and Architecture
- Training
- Evaluation
- Fine-Tuning and Optimization
- Testing and Validation
- Iterative Improvement

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I am a passionate and results-driven professional with a deep interest and beginning experience in the intersection of Machine Learning (ML), DL, and Computer Vision (OPENCV) . I am always open to exploring new opportunities, collaborating on exciting projects, and connecting with fellow professionals in the field. Languages I know C++ ,Python and bit knowledge of SQL.

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