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Automatic Generation of Document Formatting Parameters based on Device Capabilities

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ABSTRACT

Users may view and/or edit documents on a variety of devices, with different screen orientations (portrait/landscape), size, resolution, etc. If a document formatted for viewing on a particular type of device is displayed on a different type of device without taking into account device capabilities, the resulting user experience may require the user to perform cumbersome zoom, pan, or scroll operations. This is because the formatting and visual choices made for the document on the original device may not necessarily be optimal for viewing on the other device. This disclosure describes the use of a trained machine learning model to automatically generate parameters for document formatting to eliminate the need for such manual actions. The parameters include font size, margins, page orientation, etc. The parameters can be provided to the document application which can automatically format the document accordingly. The described techniques thus provide improved document viewing experience without requiring modifications to the document viewing application.

KEYWORDS

- Word processor
- Document editor
- Document viewer
- Responsive design
- Page formatting
- Page margin
- Page orientation
- Font size
- Screen size
- Display resolution

BACKGROUND

Many users utilize multiple devices with screens, such as desktop, laptop, tablet, smartphone, etc. Users often employ such devices for document viewing and/or editing. For the

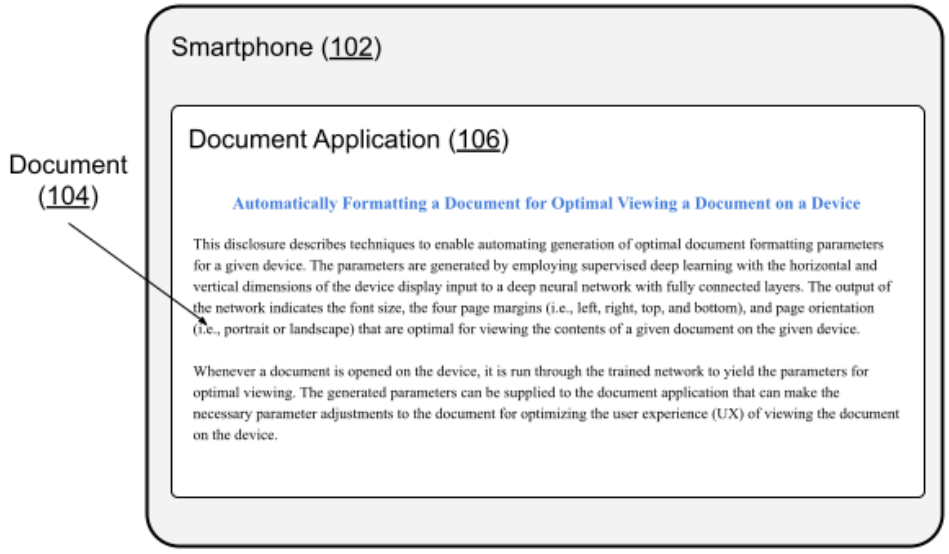
purposes of handling documents, each device type may primarily serve the purposes of document creation and editing or document viewing. For instance, devices with greater interactive capabilities and larger screens, such as desktops and laptops, offer the convenient combination of keyboard, mouse, and touchpad as input modes to write and modify documents. In contrast, devices such as a tablet may serve primarily as a display to view documents and other information since typing and recording information on such devices is cumbersome and the input mechanisms are limited in capabilities.

The formatting and visual choices made for viewing a document on the original device on which the document was created may not necessarily be optimal for viewing on other devices with different screen parameters. For instance, the originally chosen font sizes, margins, page orientation, etc. may be smaller or larger than those required for comfortable viewing on a device with smaller screen size and/or resolution. In such cases, viewing the document requires the user to frequently zoom in and out, scroll, pan, or manually change font sizes and other document parameters each time they view the document on a different device.

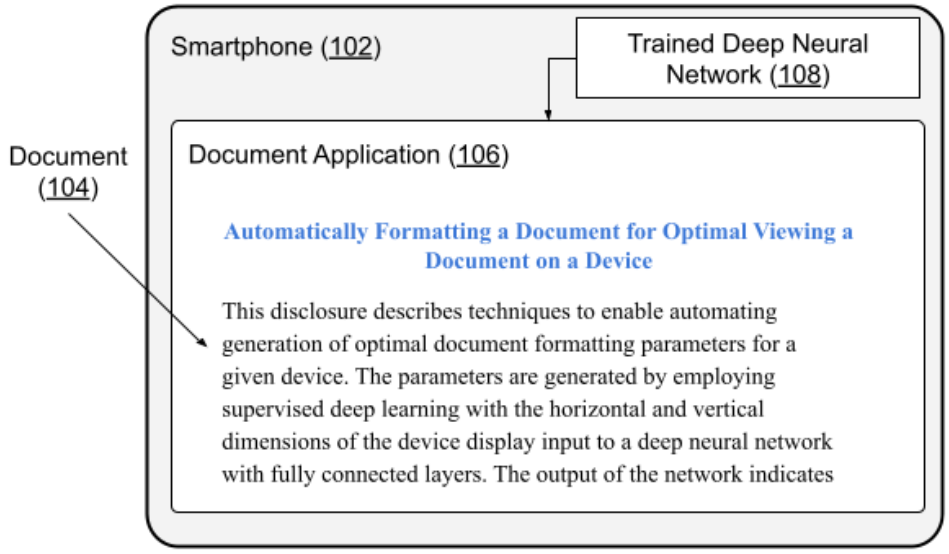
DESCRIPTION

This disclosure describes techniques for automatic generation of optimal document formatting parameters for a given device. The parameters are generated by employing supervised deep learning with the horizontal and vertical dimensions of the device display provided as input to a deep neural network (DNN) with fully connected layers. The output of the network indicates the font size, page margins (left, right, top, and bottom), and page orientation (portrait or landscape) that are optimal for viewing the contents of a particular document on the given device. The DNN (or other trained model) operates entirely on device, or if the user permits, securely on a cloud server.

Whenever a document is opened on the device, with user permission, it is run through the model to obtain the parameters for optimal viewing. The generated parameters can be supplied to the document application that can make the necessary parameter adjustments and provide the user an optimized viewing experience.



(a) Source document - small font size and small margins



(b) Optimized document - font size and margins adjusted for device screen

Fig. 1

Fig. 1 shows an example of operational implementation of the techniques described in this disclosure. A document (104) is created on a large screen device, e.g., a desktop or laptop computer. A user opens the document in a document application (116) on a different device such as a smartphone (102). The smartphone has a smaller screen than the laptop.

As seen in Fig. 1(a), if the document is shown in the original font size, the smaller screen of the smartphone results in the displayed text being too small and margins that are too wide, providing a less than optimal document viewing experience that requires the user to zoom/pan/scroll the document multiple times to view the content. Per the techniques described herein, a trained model is used to generate parameters to reformat the document to better fit the smartphone screen. As seen in Fig. 1(b), by reformatting the document according to the font, margin, and orientation parameters generated by a trained deep neural network (108) as described above, the document display is automatically adjusted to provide larger font sizes and wider margins optimally suited for comfortably viewing the document on the smartphone.

Generation of the formatting parameters and their subsequent application to the document being viewed occurs on-the-fly when the document is opened on the device used to view the document. As a result, achieving an optimal viewing experience does not require the user to break the natural flow of actions for viewing the document by taking any manual actions or making any manual edits or changes to the document.

The techniques described herein can be implemented using a suitable neural network architecture. For instance, the network can employ 16 fully connected layers with 32 nodes for each layer, with the two input nodes consisting of the horizontal and vertical screen dimensions of the device and the seven output nodes providing the optimal formatting parameters for the document - font size, the four margins, and page orientation. To ensure that a specific orientation

is utilized, the orientation variable is one-hot encoded into a dimension-2 vector by applying a selective SoftMax operation before the orientation node layer to achieve [0,1] normalization with the sum equaling 1. As such, the one-hot encoding results in values of [0,1] or [1,0], corresponding to the landscape and portrait orientations respectively.

The deep neural network can be trained with any appropriate data. For instance, a training dataset can be generated via lab studies to obtain measures of perceptual quality of document formatting parameters on devices with a variety of screen sizes. The techniques can be implemented on any suitable device and can support any document viewing application that can take the generated parameters as input. Implementation of the techniques eliminates the need for users to make manual adjustments to the document viewport or document formatting for comfortable document viewing on a given device, thus significantly improving the user experience of document viewing on a large variety of devices. The techniques provide a document viewing experience similar to that provided by websites that implement responsive design.

CONCLUSION

This disclosure describes the use of a trained machine learning model to automatically generate parameters for document formatting to eliminate the need for such manual actions. The parameters include font size, margins, page orientation, etc. The parameters can be provided to the document application which can automatically format the document accordingly. The described techniques thus provide improved document viewing experience without requiring modifications to the document viewing application.

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