SMART JOB ADVISOR

Using Image Analysis to Automate Control of a Million Dollar Printing Press

MANUAL SELECTION OF PRINTING SETTINGS CAN BE TIME-CONSUMING

- HP's Corvallis site currently utilizes multi-million dollar printing presses to produce printing jobs for large rolls of paper at up to 16 feet (4.88 m) per second.
- To begin a printing job, expertise from well-trained staff (operators) is required to manually select the right paper and settings such as printing speed, tension of the paper, drying temperature, amount of ink, etc. Mistakes in these settings can be costly and wasteful. Therefore, it is important that these decisions are made carefully.
- We aim to automate the selection of paper and settings through analysis of PDFs received for printing jobs, and in the future, serve as a training model for a machine learning application to enhance.
- We assessed three printing risks: wrinkle/curl, flaking, and streaking

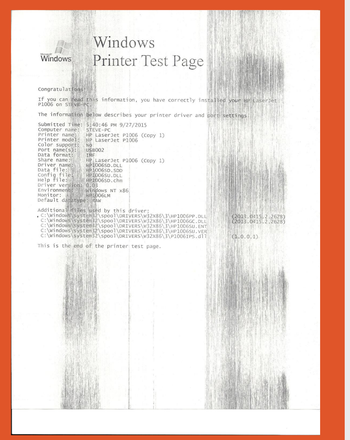

Fig 1. A visual example of how printing errors can affect printed papers

WRINKLE/CURL ALGORITHM

- Wrinkling/curling is a risk characterized by wavy and curling printed paper. It is caused by pages of large amounts of overall ink coverage, especially with widely differing coverages between opposing sides and borders
- This algorithm searches for different hues of color and weights their coverage according to their respective ink densities. For example, darker colors have additional black ink in them that results in more ink on the page
- A value is then assigned to the overall ink coverages. Risk is assessed according to the overall coverage and difference in coverages between front/back and border/inside

Fig 2. Three different operations done to an image in the wrinkle/curl algorithm. The image is loaded as an RGB image, converted to HSV, and then thresholding is applied to the pixels in the image that allows the algorithm to selectively pick pixels within the red hue area, which is shown in the rightmost picture

STREAKING ALGORITHM

- Streaking is a common printing defect that leaves unwanted streaks on the paper caused by large coverage overlap areas. The paper wrinkles so much from the water that it hits the print head
- The algorithm detects streaking by identifying significant areas of overlap on a duplex page (front and back) page areas of high saturation red, green, and blue.
- This algorithm creates a mask for the RGB regions of a duplex page to detect and extract contours, contiguous regions of those colors on a duplex page. These overlapping contours are then compared against predefined parameters to provide a risk assessment based on the number of risk pixels associated in the entire image

Fig 3. Masking and finding contours within image. Image 1 is loaded as RGB image and converted to HSV. It is masked for RGB duplex overlap to produce image, then converted to grayscale and blurred to prep it for finding its contours. Then the contours are analyzed against parameters to produce a risk score for each page based on coverage

FLAKING RISK ALGORITHM

- Flaking, a common printing issue, results from high-density ink layers. This is specially so with secondary colors (red, blue, green), where the ink fails to adhere properly to the substrate.
- This algorithm addresses this by analyzing color intensity in the HSV (Hue, Saturation, Value) color space within the PDF document intended for printing. This analysis estimates ink layer thickness and predicts the post-printing flaking risk.
- This predictive capability enables pre-emptive selection of printer settings to reduce flaking risk. This not only enhances print quality but also decreases waste due to reprints. Future algorithm enhancements will consider additional variables like paper type and ink characteristics for a more comprehensive risk assessment.

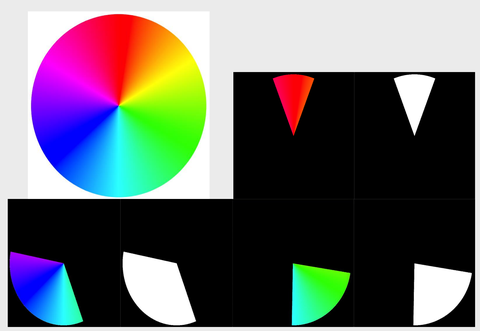

Fig 4. This image shows how the algorithm masks and outlines high intensity secondary colors (red, blue, green)

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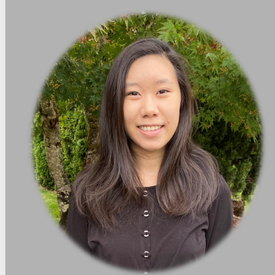

Lucy Lin (Top left)

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