Improving Data Transmission in Fiber Optics by Detecting Scratches on the Fiber End-Face

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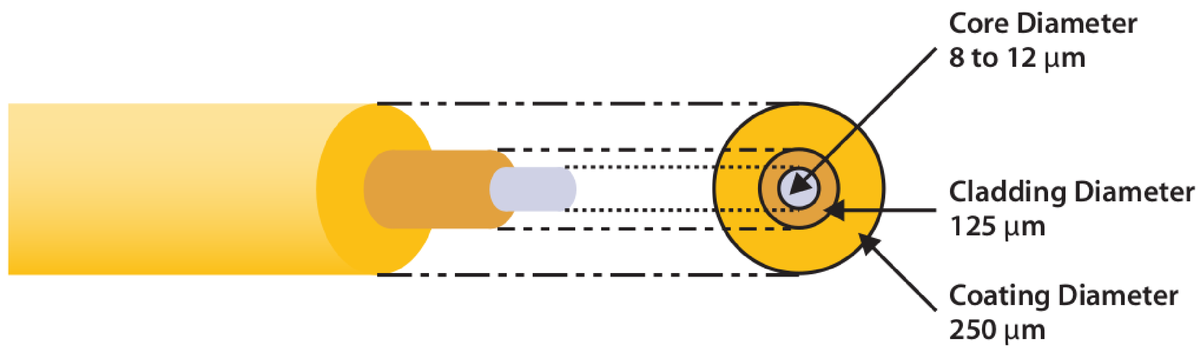
Introduction

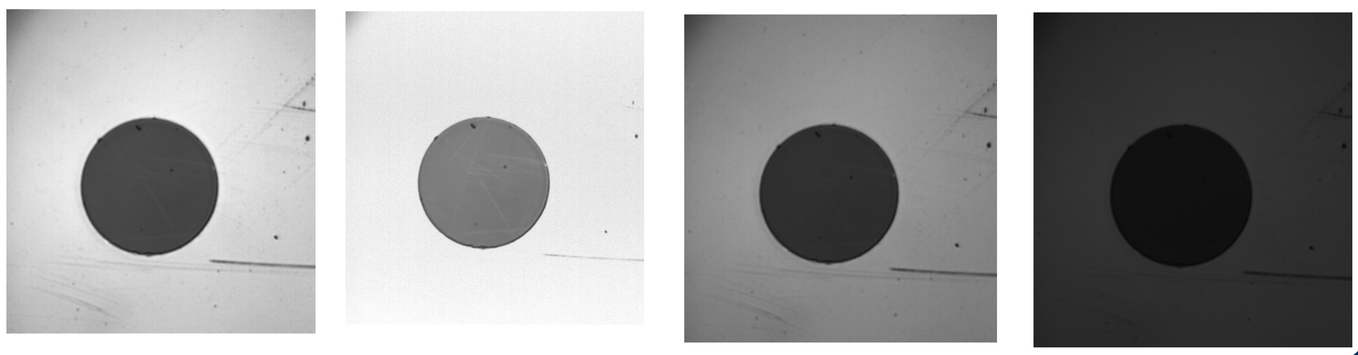
Optical fiber is the main medium for information transmission in optical communication technology and it is essential to find out the factors that cause degradation of the communication quality. The fiber connector end-face inspection is effective and is also critical to the analysis of fiber communications due to the fact that defects in this area proved to be the main reason for network failures.

The small core diameter of single-mode fiber decreases the number of propagation modes. Small scratches in the core can significantly reduce the transmitted power.



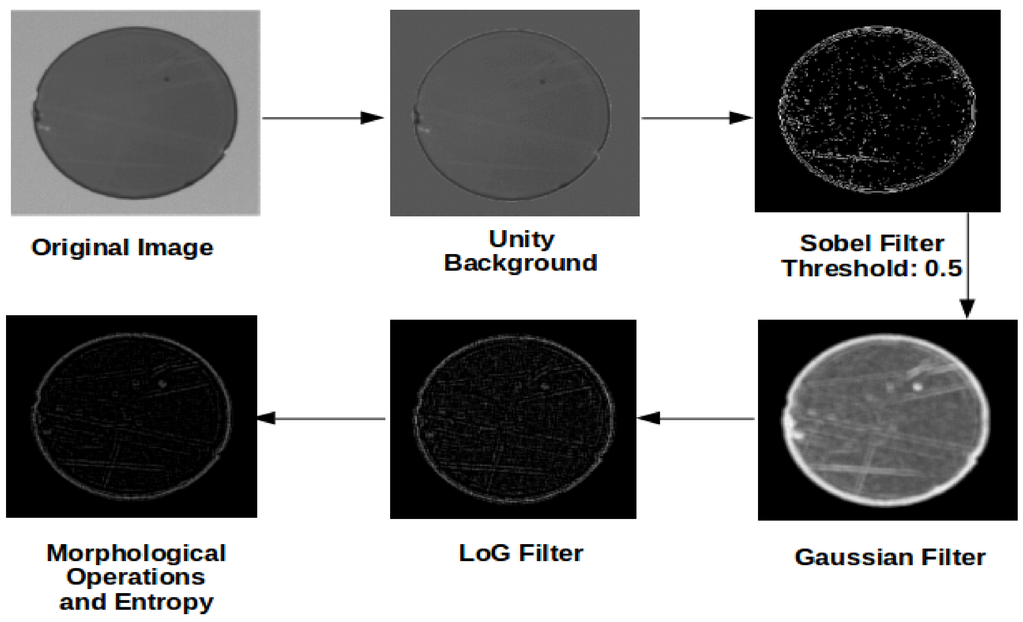
Data Challenges

- **Measurement equipment dependent factors**
- **Low contrast images**
- **Different gain and exposure**
- **Different resolution**
- **Different illumination**
- **Rotation affects contrast**



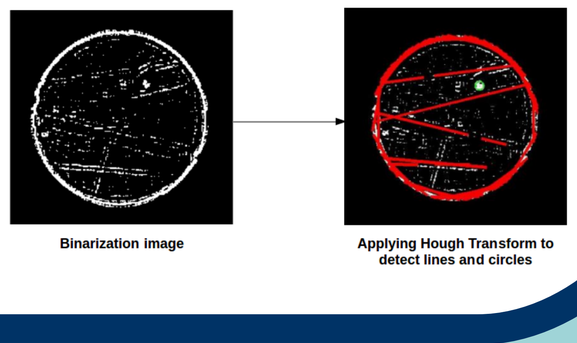
Scratch Detection Method

1. Pre-processing steps

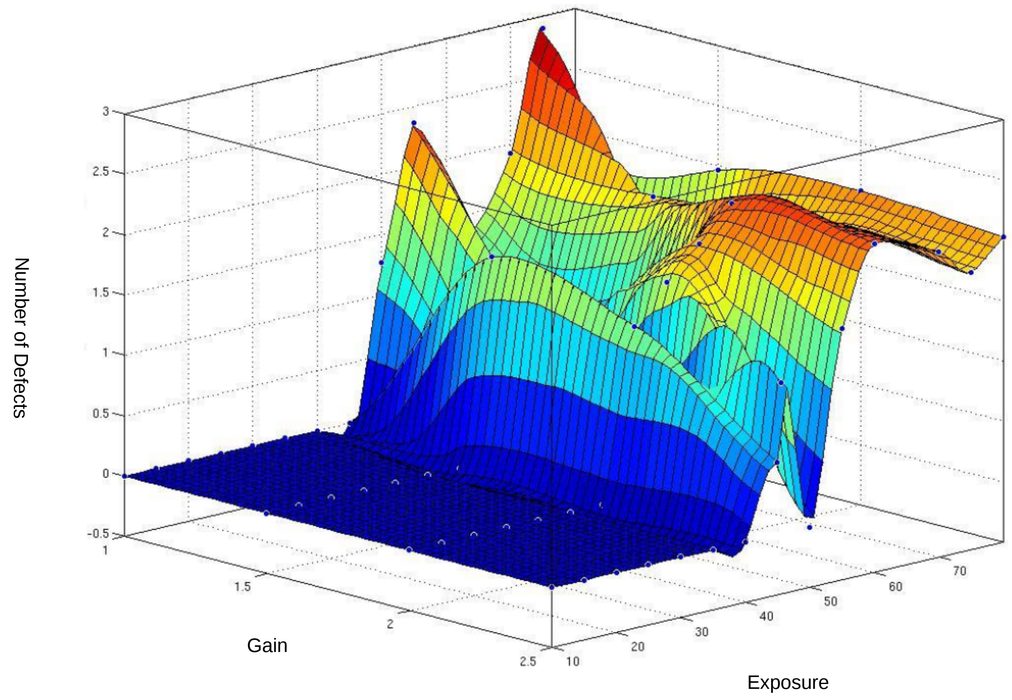


2. Hough Transform Line and Circle Detection

Hough Transform is a robust method to counter the problems of noise, occlusion and varying illumination in the images.



Result



60 images were processed in this study. When the gain and exposure are both low, it is hard to detect the scratches. When the gain and exposure are both high, the defect recognition model performs very well. Therefore, this corner is very appropriate for optical fiber defect recognition and analysis.

Conclusion

we developed a novel model to analyse the effect of scratches and pits on the end face of optical fiber connector. We processed images by using a combination of filters and identified the scratches by applying Hough Transform line detection technique. In addition, we implemented a method to investigate the distribution of the defects on the end face of optical fiber in order to judge its impact on information transmitted through optical fiber. We established the images were taken with the high gain and high exposure were performed well for optical fiber defect recognition.

References

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[2] Z. He, W. Mahmood, E. Sahinci and Y. Pradieu, “Analysis on the effects of fiber end face scratches on return loss performance of optical fiber connectors,” Journal of lightwave technology, vol. 22, no. 12, pp. 2749, 2004.

[3] E. Avram, W. Mahmood and M. Ozer, “Quantification of scattering from fiber surface irregularities,” Journal of lightwave technology, vol. 20, no. 4, pp. 634, 2002.

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