

# CS 665 Final Project Proposal

Eric Welch

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## Goal

I would like to implement the transfer learning decision forest used for optical character recognition by Goussies et al (2014). I find the idea of transfer learning particularly interesting since humans learn many things by analogy, and it seems interesting to explore the space of related machine learning tasks – indeed, it seems comparable to the notion of reducibility from computation theory. I’m also drawn to the paper because in a few short pages it makes reference to half a dozen concepts (generative models, Mahalanobis distance, and decision trees, to name a few) that I have touched on but not investigated in much depth in the past two years. I’d also like to know how to implement OCR for some side projects that I’ve had percolating for a few months.

## Relevance

I have used random forests in my work on the ANTARES project, but only as a black box, relying entirely on a library implementation. I believe that my forthcoming paper for this project and my future work in machine learning will benefit if I gain an understanding of the mathematics that underlie decision trees, and extend their use into new techniques. On another note, in my research on graph drawing symmetries I am searching far and wide for insights into how our perceptual system preattentively detects symmetry in collections of lines and points, and I suspect that by comparing the technique used in this paper to some of the other OCR techniques, I am likely to discover some techniques for detecting and describing higher-order shapes constructed by our perceptual system from composites of simple curves.

## Criteria for Success

By the end of the semester, I expect to have completed a program that can train on a sample of printed or handwritten characters, and predict a string of characters in the same alphabet from a comparably-generated sample.

## Evaluation

In addition to the technique described in the paper, I intend to implement at least two other techniques described in the abundant OCR literature and compare their performance. I hope to be able to implement a newer approach such as discriminative locality alignment (Tao et al, 2012). If this turns out to be too complex, there are other methods that seems simpler (Liu et al, 2013; Eikvel, 1993). For the evaluation, I will use standard datasets, such as the MNIST handwritten digits.

## References

1. Goussies et al. (2014) Optical Character Recognition Using Transfer Learning Decision Forests. 2014 IEEE International Conference on Image Processing.
2. Tao, Liang, Jin, and Gao (2012). Similar handwritten Chinese character recognition by kernel discriminative locality alignment. Pattern Recognition Letters.
3. Liu, Yin, Wang, Wang (2013) Online and offline Chinese character recognition: Benchmarking on new databases. Pattern Recognition. vol 46 issue 1.

4. Eikvel. OCR - Optical Character Recognition (1993). Report No 876. <https://www.nr.no/eikvil/online.html>