Golden Mean: Generating Perfect Handwritten Characters

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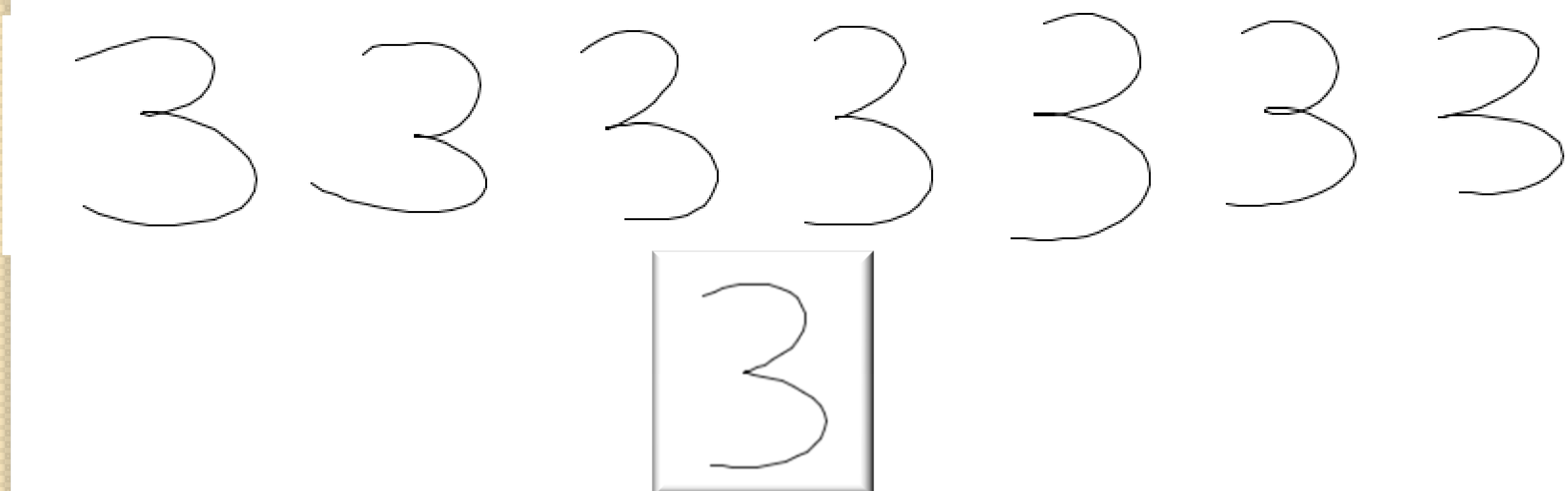
Introduction

- It was shown that a picture of an "average" face among a set of given faces looks "pretty".
- We follow the same concept to generate the perfect handwritten character, i.e. compute an average sample of a set of provided samples of the same character.

Example of an average "3"



How to find an “average” sample?

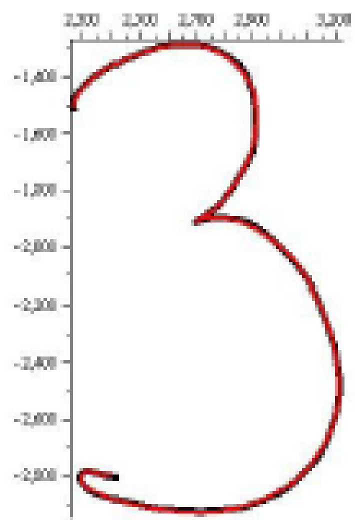
- It’s not trivial to compute an average from raw coordinates of characters – coordinates do not correspond between different samples.
- We take another approach – represent a character by coefficients of approximation with orthogonal series.

Digital *handwriting*

- Represented as a sequence of points

  $(x_0,y_0), (x_1,y_1), (x_2,y_2)\ldots$

- Each point contains one value of certain channel

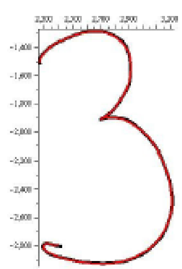


Decomposition of Channels

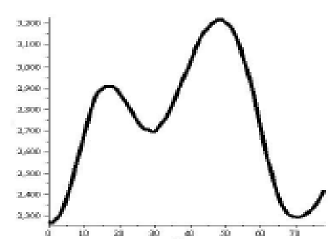
- Consider X and Y coordinates separately, as functions, say, of time:

(x_0,y_0),		(t_0, x_0),		(t_0,y_0),
(x_1,y_1),	$\longrightarrow$	(t_1, x_1),	and	(t_1,y_1),
(x_2,y_2)…		(t_2, x_2)…		(t_2,y_2)…

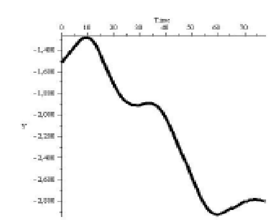
- Then



X(t)



Y(t)



Approximation of a Character

- A function can be approximated with orthogonal polynomials $P_0, P_1, \ldots$:

$$f(t) \approx \sum_{i=0}^{d} c_i P_i(t)$$

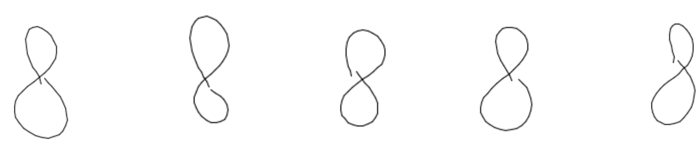
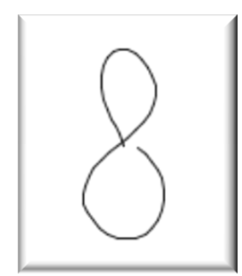
- We approximate $X(t)$ and $Y(t)$ and obtain

$$c_0^X, c_1^X, \ldots, c_d^X, c_0^Y, c_1^Y, \ldots, c_d^Y$$

Average sample

- We compute the average LS coefficients of given samples to obtain the “Golden Character”

Avg() = 

Avg() = 

Conclusion

- This method can be directly applied to calligraphy of recognized characters, generating dynamic cursive font, specific to personal handwriting.

- The method can also be used to generate representative handwriting of certain groups with respect to geographical location and/or historical time span.

Thank you!