

Autocomplete Hand-drawn Animations (Primary Paper)

Jun Xing, Li-Yi Wei, Takaaki Shiratori, and Koji Yatani. 2015. Autocomplete hand-drawn animations. *ACM Trans. Graph.* 34, 6, Article 169 (October 2015), 11 pages. DOI: <https://doi.org/10.1145/2816795.2818079>

One of the most popular art forms and communication mediums is hand-drawn animation. However, even the experienced professionals feel it challenging to produce. Users need to maintain a consistent temporal flow across multiple frames long with appropriate spatial arrangement in one frame. This difficulty can be improved by existing computer graphics methods to some extent by reusing the underlying art content, like cloning the animated texture sprites or deforming shape templates. Anyway, manual drawing provides us with a unique freedom of expression as well as more natural touch for majority of the artists. Therefore, we can say that there is a pressing need for more interactive tools which can support the creation of manual animation even more effectively while at the same time maintaining the artist's practices of natural drawing. This demand is not just for the professionals reason being that there is a rise of social and mobile applications for authoring as well as sharing hand-drawn animations that are being used by many amateur artists. The authors of this paper present us with an interactive drawing system which helps the users produce animation more easily as well as in a much better quality while at the same time maintaining manual drawing practices as mentioned above. The users simply have to create a series of drawings in our system as they would generally do in their common tools. Then what our system does is that it records and analyzes their past drawings in the background and then it provides them with suggestions which can save the manual labor and improve the quality of the drawing. The authors say that the system can detect potential repetitions like static objects as well as dynamic motions and predict what needs to be drawn across spatial locations and temporal frames. The users can accept, ignore, or modify the suggestions given by the system analogous to the mechanisms for autocomplete spatial repetitions for single static sketches. Later on the users can modify those existing animations like they might want to change the colors or shapes of certain objects. They simply can make any desired changes visually in one frame, and our system would propagate such changes across similar spatial objects at all temporal frames to reduce manual repetitions that can be tedious. The authors of this paper say that our system allows the users to create animations with topological changes like growing plants or breaking objects, unlike many deformation methods that exist. As depicted in the figure below, our user interface is designed in such a way that has similar visual appearance to the standard keyframe animation authoring tools. The users will be able to sketch each frame in the main canvas as well as play the frames as animation. Meanwhile, our system

records and analyzes their sketches in the background automatically and consequently predicts what the users might want to draw next as well as visualizes the predictions on the canvas directly, which the users could accept or modify or totally ignore analogous to the spatial hints. The design of such features reduce the manual workload and improve the quality of the output while maintaining the natural manual sketch practice as mentioned earlier in the discussion of this paper.



The authors feel that there are few limitations and that there is a scope for few future improvements. The core of our system is the analysis as well as synthesis of drawing repetitions. The authors say that since the current method has been built upon the assumption that the users draw in a very coherent fashion across the frames and hence it is not guaranteed to give suggestions and predictions that the users will wish to apply.

Also, the current system is designed to provide interactive performance, but there can be further enhancements on its quality by using machine learning techniques which the authors say that it showed promising performance in text and handwriting synthesis. Lastly, the current implementation as well as the user study are based on a pen-input system. The authors of this paper plan on deploying a touch-screen version of the discussed system in the future to further evaluate and refine its usability for mobile devices which in-turn allows for the possibility of crowdsourcing in order to help learn as well as create various animations.

Handwriting Beautification Using Token Means (Secondary Paper)

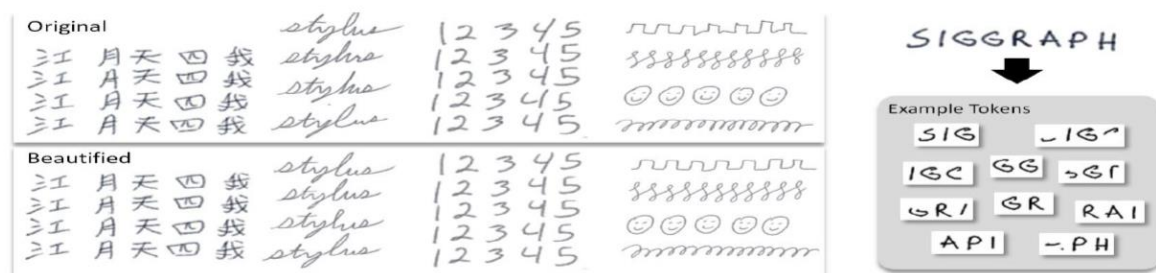
C. Lawrence Zitnick. 2013. Handwriting beautification using token means. ACM Trans. Graph. 32, 4, Article 53 (July 2013), 8 pages. DOI: <https://doi.org/10.1145/2461912.2461985>

This paper proposes a general purpose approach to beautification of handwriting using online input from a stylus. If a sample of writings, drawing, or sketches from the same user is given, the method or the approach discussed in this paper would improve the user's strokes in real-time as they are drawn. The approach discussed in this paper relies on one main insight that the appearance of the average of multiple instances of the same written word or the shape is much better than most of the individual instances. This observation is utilized by the authors and they have used a two-stage approach to elaborate on this topic.

- 1) The authors proposed an efficient-time method in order to find matching sets of stroke samples called tokens in a very large database of user writings.
- 2) They refined the most recently written strokes of the user by averaging them with the matching tokens.

This approach does not require a database of predefined letters, or words, or shapes and works well without handwriting recognition. Improved results for a wide range of writing styles and drawings have been showed in this paper.

For many decades, the primary method of communication has been handwritten documentation. The very common use of paper and pencil provides an intuitive as well as a simple user interface for the purpose of creating a wide range of artifacts from day-to-day notes to technical documents and also the artistic illustrations as well. While the use of paper and pencil has been proven to be very versatile, it might take many years to study and learn how to write legibly. Many people's notes are still difficult to read without having carefully and slowly written even after significant schooling. In the recent times, there has been an increase in interest in the computers which are of the tablet form factor, which was further lead by an associated interest in various alternative methods for the user interaction beyond a keyboard and mouse. The use of multi-touch and stylus input is inclusive of these. The use of a stylus along with a tablet computer closely mirrors that of a paper and pencil, while at the same time providing the ability to re-imagine as well as improve the experience. This paper proposes a novel approach to beautifying handwritten notes using a stylus and a tablet. The approach discussed in this paper relies on one main insight that the average of multiple instances of a handwritten shape or word in general is much better than the individual instances. For example, the below snapshot shows us several examples of shapes or words being written multiple times.



In each of the instance above, we can see a significant variation. If the strokes are pulled towards the mean, we can achieve a more consistent and a pleasing result. Furthermore the variation in the writing is reduced when the averaging is performed throughout the document, which further increases its overall visual quality and readability. Hence, we say that we gain back some of the typed text benefits while still maintaining the ease of use as well as the versatility of stylus-based input.

The approach discussed in this paper has several critical properties:

- 1) In the user's handwriting, the end result are notes which supports the fact that handwriting recognition and replacing the typed text of the user with a typed text will not be performed. Indeed, the handwriting recognition is not performed at all.
- 2) The appearances of many written forms such as text, Chinese characters or various commonly drawn shapes are improved.
- 3) Lastly, a real-time method is proposed in this paper, which transitions the original strokes of a user into refined strokes shortly after they have been written. The user's strokes are represented using overlapping fixed length sequences of stroke samples which are called tokens. These tokens represent the parts of shapes or words as well as contain information about both strokes (pen down) and the spacing between strokes (pen up). The samples which ate within a token might only include a part of single stroke or span multiple strokes are shown in the snapshot figure above. Beautification is performed by averaging the most recently written token of a user with similar previously written tokens. The authors say that it is very important to perform this averaging operation using the correct stroke sample representation. The average that is within the space must produce a result which agrees with what one might intuitively understand as an average. For example, the average of multiple handwritten instances of the word "stylus" should still look like "stylus" (refer the snapshot figure above). The authors' solution is a stroke sample representation using curvature-based sampling. This particular representation when done along with clustering allows us for efficiently searching similar tokens in a large database of stroke samples of the users in real-time. The results are shown for various users writing various forms of shapes and texts. In

this paper, the user studies depict clear improvements in the quality as well as the consistency of the handwriting of a user.