

## Multimedia Systems Laboratory



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## Refereed Journal Papers

- [jps shin-01:2013] Kunseok Oh Kouhei Miura, Jungpil Shin. Personal Identification on Free Text using Pen Pressure and Inclination. *Journal of Next Generation Information Technology (JNIT)*, 4(5):36–43, July 2013.

In this paper we propose a personal identification method on free text using pen pressure and pen inclination. In the field of personal identification based on handwriting, almost research has been focused on signature verification. However, signature verification has a serious problem that is possibility of a forged signature appearance. To solve this problem, a personal identification method to use the free text was introduced. In the previous research, any handwriting characters are accepted as a text in the identification process, and the text used in the identification process can be different from that in the enrollment process. The proposal method uses pen pressure and pen inclination of invisible information of handwriting for the previous method, and improves the performance of personal identification by showing the results of the identification experiment.

- [jps shin-02:2013] Ui-Pil Chong Anuva Chowdhury, Jungpil Shin. Fusion of Background Subtraction and Clustering Techniques for Shadow Suppression in Video Sequences. *Journal of The Korea Institute of Signal Processing and Systems*, 14(4):231–234, Oct. 2013.

This paper introduces a mixture of background subtraction technique and K-Means clustering algorithm for removing shadow from video sequences. Lighting conditions cause an issue with segmentation. The proposed method can successfully eradicate artifacts associated with lighting changes such as highlight and reflection, and cast shadows of moving object from segmentation. In this paper, K-means clustering algorithm is applied to the foreground, which is initially fragmented by background subtraction technique. The estimated shadow region is then superimposed on the background to eliminate the effects that cause redundancy in object detection. Simulation results depict that the proposed approach is capable of removing shadows and reflections from moving objects with an accuracy of more than 95 % in every cases considered.

- [jps shin-03:2013] Jungpil Shin and Makoto Marumoto. Ink Diffusion Simulation for 3D Virtual Calligraphy. *Journal of Advanced*

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*Computational Intelligence and Intelligent Informatics (JACIII)*, 17(4):598–603, July 2013.

The calligraphy is one of traditional culture in Japan. In the calligraphy, writers express their feeling by using various shapes of strokes and various effects such as scratchiness and ink diffusion phenomenon. Therefore, scratchiness and ink diffusion phenomenon are crucial features in calligraphy. The purpose of this paper is realization of ink diffusion phenomenon which is one of the important features in 3D Virtual Calligraphy Simulation. Ink diffusion phenomenon is influenced by various factors such as the conditions of the ink, paper, and brush. In this paper, the extent of ink diffusion phenomenon and ink color is considered on density of ink and quantity of water. Cased by these factors, to express ink diffusion phenomenon in 3D Virtual Calligraphy Simulation in real time, new drop model was used. Ink diffusion phenomenon occurs when ink is diffused circularly. Using this principle, created a drop model and realized ink diffusion phenomenon. By this method, a feathery, blurred edge that is characteristic of ink diffusion phenomenon is also able to be expressed.

[jpsin-04:2013] Jungpil Shin, Toshiki Okuyama, and Keun-Soo Yun. Realization of On-line Handwriting Calligraphy Learning System. *Journal of Next Generation Information Technology (JNIT)*, 4(6):18–27, Aug. 2013.

This paper describes about realize the sensory calligraphy learning system. In this paper, a pen tablet is used as an ink brush. In order to evaluate a character, the necessary information to be acquired from the pen tablet is XY-coordinate, pressure, and elevation. We verify the Chinese character of one character “永” containing fundamental type of the Chinese character. First, the data of the character “永” inputted as a model is divided for every stroke. Furthermore, 13 points used as the feature of “永” is determined in this paper. This paper compares the value of those points and decides the feature of the data by calculating the distance. And, this paper also uses the information on XY-coordinate, pen pressure, and elevation, as a comparative feature. Next, the user inputs strokes. This system returns to the user the result which compares and analyzes the value of the data of the model with the value of the calculated data. The user is notified of the problems from the result and efficient study can be performed by repeating the exercise. We are these methods and verified the system. As a result, this calligraphy learning system which can evaluate every stroke the examinee inputs was realiz-

able. And, we verified that by using this system, examinee has grasped the problem visually and has made progress efficiently. We believe that calligraphy learning system realized in this thesis is effective for studying individually.

- [jpshin-05:2013] Kotomi Ishida, Jungpil Shin, and Kunseok Oh. Learning Effect of Chinese Handwriting Learning System. *Journal of Convergence Information Technology (JCIT)*, 8(15):71 – 80, Nov. 2013.

This paper describes the educational effect of Chinese character handwriting learning system which was made for the grade-schooler and the foreigner to study Chinese character joyfully and efficiently. Two experiments were conducted on college students to verify educational effect of this. Educational effect was defined (1) the change of percentage of correct answers (2) learning time and (3) the number of times writing Chinese character in once learning time. First, we measured educational effect to learn stroke order of Chinese character in experiment. Second, we compared educational effect between learning process of this system and usual learning process writing Chinese character on paper. From experiments, first we could confirm that Chinese character learning system can give large educational effort about the stroke order of Chinese character to students. Second, this system can be given more educational effect than the usual learning process to write Chinese character many times.

- [jpshin-06:2013] Ryota Saito, Jungpil Shin, and Kunseok Oh. Oriental Brush Simulation based on Brush Rotation Model. *Journal of Convergence Information Technology (JCIT)*, 8(15):81 – 88, Nov. 2013.

In this paper we describe a novel method to simulate the handwritten character of oriental brush character based on the brush model with brush ahead's rotation and express the brush scratchiness. First, we extract the feature of xy-coordinates, pen pressure, direction and altitude from the pen tablet. At this time, the change of the virtual brush shape is enabled by the handwriting. The stroke of written character changes according to the shape of the brush. Second, according to the pen down, the initial direction of the brush ahead's end is changed from the inclination, and the hair end is rotated in the direction opposite to the moving direction of the brush. Third by this method, a smooth curve is drawn, and a virtual brush can be close to an actual oriental brush. Finally, for the generation of the scratchiness in the written character, brush speed is calculated and the amount of ink that moves from the brush to paper

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is adjusted. By the experiment, we confirm that the drawn stroke in the curve with a smooth line from the starting point of the brush is successful to show the close shape to an actual oriental brush and the scratchiness effect could be generated by part where the speed is fast.

- [jpshin-07:2013] Mamiko Tano, Jungpil Shin, and Si-Woong Jang. A Tracking System for Multiple Human Moving Objects using Snakes Algorithm. *Journal of Next Generation Information Technology (JNIT)*, 4(9):28–36, Nov. 2013.

In this paper we present a novel algorithm to extract the multiple human moving objects using Snakes. The object of the unknown number is able to be extracted by setting an initial outline that enclosed the entire image and dividing the Snakes. This system is divided into two stages for the extraction processing of the movement object. In the first stage, the area of the movement object is extracted by using the background difference for the preprocessing. In the second stage, the split and merge Snakes is used for the extraction that uses Snakes. The same object can be extracted by expanding and reducing the same Snakes, when the object is extracted with Snakes in the previous frame. Furthermore, an outline model can be reduced by set an initial outline into the frame of image, and new object is extracted. By the experiment for human tracking, two or more movement objects were able to be extracted. Even if the image contains small noise and the edge of moving object is not able to be detected, a smooth profile line of the object could be extracted by Snakes.

- [jpshin-08:2013] Jungpil Shin and Toshiki Okuyama. Detection of Alcohol Intoxicated via Online handwritten Signature. *Pattern Recognition Letters (Elsevier Science)*, 35(1):101–104, Jan. 2014.

The Internet has recently facilitated various methods of personal authentication based on biometrics. Personal authentication techniques based on human physical features include fingerprint matching, vein matching, facial recognition, speech recognition, and signature recognition. In this study, we investigate the detection of alcohol intoxication on the basis of handwritten signatures. As in the case of previous related studies, we found that the signature attestation rate varies at an individual level according to sex, age, acetaldehyde removal efficiency, and individual constitution. In this study, we employed 30 people to evaluate the change in a handwritten signature before and after alcoholic intake. First, we measured the signature verification rate using the online signature veri-

fication system. The signature verification rate measured using the WACOM Tablet pen before alcohol consumption was 97.0% of the characters and the interval between the characters were measured for signatures collected after alcohol consumption. We detected the level of alcohol intoxication on the basis of the total time taken for writing the signature, the average pressure of the brush, the two-dimensional writing speed, and internal angle of stroke turns. The maximum alcohol detection rate of this method was 95.135% min after alcohol consumption. The rate of alcohol detection increases with the alcohol density in an examinee's breath.

- [jpshin-09:2013] Yuki Nakai, Jungpil Shin, and Kunseok Oh. Robust Head Tracking System Based On Hierarchical Division. *Journal of Next Generation Information Technology (JNIT)*, 4(5):27–35, July 2013.

We present a real-time head tracking system corresponding to the diagonal viewpoints by using frame differences in this paper. We propose the methods for hierarchical division and circle detection for the development of this system. The hierarchical division is a technique for extracting each moving object from a frame image. Our proposed circle detection method is a technique based on presumption of the center position of a circle. By the surveillance experiment, we demonstrate the real-time performance and robustness of our system working in complex scenes. The proposed system corresponds to diagonal viewpoints from 0 to about 60 degrees by using the hierarchical division and the circle detection suffices for practical use.

- [jpshin-10:2013] Jungpil Shin Weichen Lin. On-line Signature Evaluation Method Based On Shape Feature Extraction. *Journal of Next Generation Information Technology (JNIT)*, 4(5):44–54, July 2013.

Recently, banks and companies have increased security by switching from simple static passwords to more dynamic security measures that offer greater protection for users of mobile and web commerce. The most personal method for authentication is analysis of handwritten signatures. Signature evaluation determines whether an individual's signature is considered "good" or "bad" to copy the signature. Namely, a good signature is more complex and difficult to impersonate, whereas a bad signature is simple and easy to impersonate. A signature typically contains many angles, whether big or small. A signature with a higher number of angles is more complex and is considered "good"; therefore, the number

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of internal angles was calculated to determine the quality of the signature. In this paper, we propose the algorithm used to decide the kinds of angles by the analyzing the geometrical features. In the experiment, signature verification was performed to analyze the EER (Equal Error Rate) after the evaluation, and it has been concluded that it is best to use the Neighbor method to create the best signature evaluation system.

- [naru-01:2013] S. Yamamoto, R. Nakamura, T. Matsunaga, Y. Ogawa, Y. Ishihara, T. Morota, N. Hirata, M. Ohtake, T. Hiroi, Y. Yokota, and J. Haruyama. A new type of pyroclastic deposit on the Moon containing Fe-spinel and chromite. *Geophysical Research Letters*, 40:4549–4554, 2013.

We present details of the identification of sites that show an absorption band at visible wavelengths and a strong 2  $\mu\text{m}$  band using the SELENE Spectral Profiler. All the sites exhibiting the visible feature are found on the regional dark mantle deposit (DMD) at Sinus Aestuum. All the instances of the visible feature show a strong 2  $\mu\text{m}$  band, suggestive of Fe- and Cr-rich spinels, which are different from previously detected Mg-rich spinel. Since no visible feature is observed in other DMDs, the DMD at Sinus Aestuum is unique on the Moon. The occurrence trend of the spinels at Sinus Aestuum is also different from that of the Mg-rich spinels, which are associated with impact structures. This may suggest that the spinel at Sinus Aestuum is a different origin from that of the Mg-rich spinel.

## Refereed Proceeding Papers

- [jpsin-11:2013] Tomoya Murata and Jungpil Shin. Hand Gesture and Number Recognition with Kinect Sensor. In *International Conference on Computer Applications and Information Processing Technology (CAIPT 2013)*, pages 193–196, Praha, Czech, June 2013. IEEE, IEEE.

The purpose of this research is recognition of written number in the air by the hand and calculation with Kinect sensor. Without installing anything, also, hands have not anything, because using the Kinect sensor from Microsoft. Kinect is possible to motion capture without the sensor device attached to the user body. The recognition rate of written number in the air by the hand is that measure five people was used this program,

wrote 0 to 9 with five times. The input number is recognized by Dynamic Programming matching. In addition, we can calculate with the number that is recognized. However, most people are not familiar with writing a character in the air and also used of Kinect, so detection performance of the hand of Kinect is good but take the time to write the number and hand detection. Therefore, user need to accustomed with use of Kinect in advance.

- [jpshin-12:2013] Yumi Wakaki and Jungpil Shin. Stroke Correspondence Searching Method for Character Recognition. In *The 6th International Conference on the Frontiers of Information Technology, Application and Tools (FITAT2013)*, pages 178–181, Cheongju, Korea, Sep 2013. IEEE, Chungbuk University.

For the handwritten character recognition by the tablet pen input, one of the key issue is how to recognize a character whose stroke-order changes with writers correctly. This paper proposes a novel approach using a Genetic Algorithm to realize the one-to-one stroke correspondence between a reference and an input character, and experiments were carried out in order to investigate the effectiveness of this method. We demonstrate that the proposed algorithm is very effective and has high performance in the viewpoint of recognition rate and correspondence rate and calculation time.

- [jpshin-13:2013] Shingo Watanabe and Jungpil Shin. Recognition of Character Drawn on Screen With Laser Pointer. In *IEEE 5th International Conference on Awareness Science and Technology (IEEE iCAST 2013)*, pages 93–97, Aizuwakamatsu, Japan, Nov 2013. IEEE, University of Aizu.

This paper describes approaches to recognize character strings which are drawn with a laser pointer. The recognition algorithm used is based on Dynamic Programming (DP) matching. XY coordinate, directional vector Dynamic Positional Warping (DPW) is used as data. New Inter Stroke Information was also developed and used. The information can represents shape of character. Test data are obtained by following steps: 1) taking a movie which record drawing a character string with a laser pointer on screen; 2) binarization; 3) closing operation; 4) noise rejection; and 5) thinning process. Training data are recorded with a pen - tablet. This research focuses on the laser pointer process and enables to communicate with computer in a place whose color's brightness is low and improve technology using a camera.

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- [jpshin-14:2013] Byeongkyu Ko, Jeongin Kim, Jungpil Shin, Hanil Kim, and Pankoo Kim. Expansion of Ontology Editor for Ontology Building. In *International Conference on Smart Media Applications (SMA 2013)*, pages 96–102, Kota Kinabalu, Malaysia, Oct 2013. SMA.

Ontology has been researched and used not only for information search but also various areas such as medical area and ubiquitous area. It's because ontology is able to form various inference relations and even extract new relations that can't be extracted by human in a way that it forms relations through semantic-relation analysis between objects, which is the best benefit for ontology. Therefore, ontology has been positioned as a core technology to develop domestic and overseas intelligence system and many researches to utilize ontology are under processing. However, development of tools to build ontology is still insufficient. Therefore, this paper will explain extended description to enhance the functions of Ontology Editor which is previously implemented.

- [jpshin-15:2013] Eunji Lee, Chang Choi, Seongjun Kim, Hyungkook Lee, Pankoo Kim, and Jungpil Shin. Electronic Tax Invoice System based on Smart devices: A Case Study of Balobill. In *International Conference on Smart Media Applications (SMA 2013)*, pages 542–546, Kota Kinabalu, Malaysia, Oct 2013. SMA.

Electronic tax invoices system is fully automated mechanism of VAT documents operation and further improved the efficiency of VAT administration. The market based on E- tax invoices system has grown by leaps and bounds. In this time, a lot of company wants to apply this system but it is not easy because there are not the standards for interoperation between electronic tax invoice system and legacy system. This paper proposes the authentication method for security and efficient data transmission method based on electronic tax invoice system in smart device environments. Experiment is performed evaluation comparison between SOAP and RESTful service.

- [jpshin-16:2013] Suyun Ju and Jungpil Shin. Cursive Style Korean Handwriting Synthesis based on Shape Analysis with Minimized Input Data. In *The 11th IEEE International Conference on Embedded and Ubiquitous Computing (EUC 2013)*, pages 2231–2236, Zhangjiajie, China, Nov 2013. IEEE.

In this paper we present novel algorithm for the cursive style Korean handwriting synthesis method based on the shape analysis with minimized input data. Hangeul (Korean Character) has the different charac-

teristics in structure, that is, character consists of consonants and vowels like English and also it is a combination character like Chinese character. This research aims at using minimal input character data, that is namely consonant and vowel, to synthesize all possible combination of Hangul character. First, we propose the method how to get an inter-strokes information for making position of the natural Korean character. Second, we propose how to synthesize all the Korean characters using small amount of input data and normalized one from some of representative input data. Finally we add a function that concatenates each consonants and vowels for cursive style. By the experiment, we show that the proposed method is effective for synthesis of Hangul by human evaluation.

- [jpsin-17:2013] Jungpil Shin, Toshiki Okuyama, and Keunsoo Yun. Sensory Calligraphy Learning System using Yongzi-Bafa. In *8th International Forum on Strategic Technology (IFOST2013)*, pages 128–131, Ulaanbaatar, Mongolia, June 2013. IEEE, IEEE.

In this paper, we present one of the calligraphy system for the oriental brush writing. This is used the sensory calligraphy method, so called Yongzi-Bafa in Chinese, Yongza-Palbop in Korean, Eiji-Happo in Japanese. For the evaluation of character, we acquired the information from the pen-tablet, such as XY-coordinate, pressure, pen-direction, and elevation. First, we verify 13 feature points of the Chinese character of one character “Young” . Second, the system compares the feature point of the each stroke data with the reference data. Third, this system returns to the user the result which compares and analyzes the value of the data of the model with the value of the calculated data. By the experiment by the writers, we showed this system is very efficient calligraphy learning system.

## Unrefereed Papers

- [jpsin-18:2013] Jungpil Shin Tsukada Youji. HCI by Handwriting Recognition Using Laser Pointer. In Editor, editor, *Tohoku-Section Joint Convention of Institutes of Electrical and Information Engineers*, page 2B01, Aizuwakamatsu, Aug 2013. IEIE, Univ. of Aizu.
- [jpsin-19:2013] Jungpil Shin Shingo Watanabe. HCI by Handwriting Recognition Using Laser Pointer. In Editor, editor, *Tohoku-Section Joint*

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*Convention of Institutes of Electrical and Information Engineers*, page 2A17, Aizuwakamatsu, Aug 2013. IEIE, Univ. of Aizu.

[jpsin-20:2013] Jungpil Shin Tomoya Murata. HCI by Handwriting Recognition Using Kinect Sensor. In Editor, editor, *Tohoku-Section Joint Convention of Institutes of Electrical and Information Engineers*, page 2A18, Aizuwakamatsu, Aug 2013. IEIE, Univ. of Aizu.

## Grants

[naru-02:2013] N. Hirata. Grants-in-Aid for Scientific Research (KAKENHI), 2013-2015.

## Academic Activities

[jpsin-21:2013] Jungpil Shin, June 2013.

Editor (held in Santa Clara Marriott, CA, USA (Center of Silicon Valley), June 27-July 2, 2013)

[jpsin-22:2013] Jungpil Shin, June 2013.

Organization Committee (held in Prague, Czech Republic on June 27 29, 2013)

[jpsin-23:2013] Jungpil Shin, Nov 2013.

Publicity Chair (held in Aizu-Wakamatsu, Japan, Nov. 2 - 4, 2013)

[jpsin-24:2013] Jungpil Shin, Oct 2013.

Program Committee, (held in Manchester, England, Oct. 13-16, 2013)

[jpsin-25:2013] Jungpil Shin, March 2013.

Program Committee, (held in Barcelona, Spain, 2013 March 23 - 27)

[naru-03:2013] N. Hirata, 2013.

Member of Program Subcommittee, and Editor of Proceedings

[naru-04:2013] N. Hirata, 2013.

Chair of the committee for general affairs

## Ph.D and Others Theses

## Summary of Achievement

[jpshin-26:2013] Yoshiaki Takase. Graduation Thesis: Synthesis of Handwritten style Cursive English Font Reflected Personality, University of Aizu, 2013.

Thesis Advisor: Jungpil Shin

[jpshin-27:2013] Tsukada Youji. Graduation Thesis: Kanji Learning Application for portable device, University of Aizu, 2013.

Thesis Advisor: Jungpil Shin