Papers Published in Technical Journals and Conference Proceedings

Complex Mode Analysis of Strong Motion Accelerograms

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Proc. of Japan Geoscience Union Meeting 2010, Makuhari, Chiba, Japan, May 2010.

We report the results of our analysis of strong motion accelerograms using our proprietary time series analysis method. Our method is a kind of mode analysis: we fit the given time series locally with a linear Green's function and calculate the function's poles. We can obtain sufficient frequency information even from data for a fraction of a cycle. For example, when we analyze fraction-of-a-cycle data for 20 samples, we can obtain a frequency resolution 2500 times higher than with Fourier analysis. We analyzed some accelerograms of the Iwate Engan Hokubu earthquake. We found that the main frequencies of the surface acceleration signals of the P-wave and S-wave were both 5 Hz. The decay rate of the P-wave was about 5/s (the rate is comparable to its frequency) and that of the S-wave was almost 0/s. This means that the P-wave was made up of repetitive impulsive waves and the S-wave was almost sinusoidal.

Detection of Anger Emotion in Dialog Speech Using Prosody Feature and Temporal Relation of Utterances

N. Nomoto, H. Masataki, O. Yoshioka, and S. Takahashi

Proc. of INTERSPEECH 2010, ISCA, Vol. 1, No. 1, pp. 494–497, Makuhari, Chiba, Japan, Sept. 2010.

This paper proposes a novel feature for detecting anger in dialog speech. Anger is classified into two types: loud HotAnger and calm ColdAnger. Prosody can reliably detect the former but not the latter. We analyzed both types of anger dialog in the two-party setting and discovered that they exhibited some differences in the temporal relation of utterances from neutral dialog. We created a dialog feature that reflects these differences and investigated its effectiveness in detecting both types of anger. Tests show that the proposed feature combination improves the F-measure of ColdAnger and HotAnger by 24.4 and 8.8 points, respectively, against a baseline technique that uses only prosody.

Efficient Data Selection for Speech Recognition Based on Prior Confidence Estimation Using Speech and Context Independent Models

S. Kobashikawa, T. Asami, Y. Yamaguchi, H. Masataki, and S. Takahashi

Proc. of INTERSPEECH 2010, ISCA, Vol. 1, No. 1, pp. 238–241, Makuhari, Chiba, Japan, Sept. 2010.

This paper proposes an efficient data selection technique to identify well recognized texts in massive volumes of speech data. Conventional confidence measure techniques can be used to obtain this accurate data, but they require speech recognition results to estimate confidence. Without a significant level of confidence, considerable computer resources are wasted since inaccurate recognition results are generated only to be rejected later. Our technique rapidly estimates the prior confidence based on just an acoustic likelihood calculation by using speech and context-independent models before speech recognition processing; it then recognizes data with high confidence selectively. Simulations show that it matches the data selection performance of the conventional posterior confidence measure with less than 2% of the computation time.

Body-biased Steep-subthreshold-swing MOS (BS-MOS) with Small Hysteresis, Off Current, and Drain Voltage

K. Nishiguchi and A. Fujiwara

Proc. of the 2010 International Conference on Solid State Devices and Materials (SSDM 2010), Vol. 1, No. 1, pp. 1261–1262, Tokyo, Japan.

We demonstrate a 30-nm-gate-length nanowire MOSFET with a steep subthreshold swing. A parasitic bipolar transistor formed in a fully depleted SOI MOSFET applies body bias to the MOSFET's channel and thus reduces the steep subthreshold swing to below 60 mV/dec at room temperature. Additionally, triple-gate operation allows current characteristics with small hysteresis, a high on/off ratio, and low drain voltage. These features promise SOI MOSFETs for low power consumption.

Strong Stark effect of electroluminescence in thin SOI MOSFETs

J. Noborisaka, K. Nishiguchi, Y. Ono, H. Kageshima, and A. Fujiwara

Proc. of the 2010 International Conference on Solid State Devices and Materials (SSDM 2010), Vol. 1, No. 1, pp. 796–797, Tokyo, Japan.

We report the electroluminescence from thin SOI MOSFETs when electrons are injected into a thin SOI layer by tunneling. We observed a large Stark shift of up to approximately 50 meV by applying an electric field normal to the thin SOI layer. The observed strong Stark effect indicates that strong quantum confinement in the Si/SiO_2 system plays an important role in light emission.

Character Recognition

Edited by M. Mori

Sciyo, Hard cover, 188 pages, 2010.

Character recognition is one of the pattern recognition technologies most widely used in practical applications. This book presents recent advances relevant to character recognition from technical topics such as image processing, feature extraction, or classification to new applications including human-computer interfaces. The goal of this book is to provide a reference source for academic research and for professionals working in the character recognition field.

Adaptive Feature Extraction Method for Degraded Character Recognition

M. Mori, M. Sawaki, and J. Yamato

Character Recognition, Sciyo, Vol. 380, No. 1, pp. 43–58, 2010.

In this chapter, we propose a category dependent method that achieves robustness against both deformation and image degradation. Our method estimates the degree of deformation and degradation of the input pattern on the basis of specific information about each category. Exploiting the category information enables us to extract the

variation in the aspect ratio and that in the run-length used for computing feature values. The fluctuations in shape and feature values are then offset by the estimated compensation coefficients. To evaluate our method, we applied it to the recognition of video text degraded by background noise and blurring and deformed by aspect ratio fluctuations.

One-by-one Trap Activation in Silicon Nanowire Transistors

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Nature Communications, Vol. 1, Article No. 92, DOI: doi:10.1038/ncomms1092

Flicker or 1/f noise in metal-oxide-semiconductor field-effect transistors (MOSFETs) has been identified as the main source of noise at low frequency. It often originates from an ensemble of a huge number of charges becoming trapped and de-trapped. However, as a deviation from the well-known model of 1/f noise is observed for nanoscale MOSFETs, a new model is required. Here, we report the observation of one-by-one trap activation controlled by the gate voltage in a nanowire MOSFET and propose a new low-frequency-noise theory for nanoscale FETs. We show that the Coulomb repulsion between electronically charged trap sites prevents the activation of several traps simultaneously. This effect induces a noise reduction of more than one order of magnitude. It decreases when the electron density in the channel is increased owing to the electrical screening of traps. These findings are technologically useful for any FET with a short narrow channel.

Rapid change in Articulatory Lip Movement Induced by Preceding Auditory Feedback during Production of Bilabial Plosives

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PLoS ONE, Public Library of Science, Vol. 5, No. 11, p. e13866, 2010.

Background: There has been plentiful evidence of kinesthetically induced rapid compensation for unanticipated perturbation in speech articulatory movements. However, the role of auditory information in stabilizing articulation has been little studied except for the control of voice fundamental frequency, voice amplitude, and vowel formant frequencies. Although the influence of auditory information on the articulatory control process is evident in unintended speech errors caused by delayed auditory feedback, the direct and immediate effect of auditory alteration on the movements of articulators has not been clarified.

Methodology/principal findings: This work examined whether temporal changes in the auditory feedback of bilabial plosives immediately affect the subsequent lip movement. We conducted experiments with an auditory feedback alteration system that enabled us to replace or block speech sounds in real time. Participants were asked to produce the syllable /pa/ repeatedly at a constant rate. During the repetition, normal auditory feedback was interrupted, and one of three pre-recorded syllables, /pa/, /Φa/, or /pi/, spoken by the same participant, was presented once at a different timing from the anticipated production onset, while no feedback was presented for subsequent repetitions. Comparisons of the labial distance trajectories under altered and normal feedback conditions indicated that the movement quickened during the short period immediately after the alteration onset, when /pa/ was presented 50 ms before the expected timing. Such a change was not significant under other feedback conditions that we tested.

Conclusions/significance: The earlier articulation rapidly induced by the progressive auditory input suggests that a compensatory mechanism helps to maintain a constant speech rate by detecting errors between the internally predicted and actually provided auditory information associated with self movement. The timing- and context-dependent effects of feedback alteration suggest that the sensory error detection works in a temporally asymmetric window where acoustic features of the syllable to be produced may be coded.

Orienting Kinesthetically: A Haptic Handheld Wayfinder for People with Visual Impairments

T. Amemiya and H. Sugiyama

ACM. Trans. Accessible Computing, Vol. 3, No. 2, pp. 1–23, 2010.

Orientation and position information are vital for people with visual impairments if they are to avoid obstacles and hazards while walking around. We are developing and evaluating a haptic direction indicator that delivers directional information in real time through kinesthetic cues. The indicator uses a novel kinesthetic perception method called the pseudo-attraction force technique, which utilizes the nonlinear relationship between perceived and physical acceleration to generate a force sensation. In an experiment, we found that the indicator allowed people with visual impairments to walk safely along a predefined route at their usual walking pace without any previous training, independent of the existence of auditory information. The findings indicate that the haptic direction indicator is effective at delivering simple navigational information and is a suitable substitute for and/or enhancement to conventional wayfinding methods.

Optical Flow Estimation and Counting Method of Moving Objects from a Real Environment Scene Enveloped by an Infinite Number of Particle-like Patterns

H. Sakaino

The Institute of Image Information and Television Engineers, Vol. 64, No. 11, pp. 1731–1743, 2010 (in Japanese).

In real environments, the detection and motion of an interesting moving object against a complex background in computer vision are very important. However, scenes contain many undesirable factors that can prevent stable detection such as occlusion, lighting changes, and a jittery background. In addition to these, an infinite number of randomly moving particle-like patterns can make moving objects more difficult to detect. These particles have ambiguous edges and no definite shape. In a more complicated scene, we assume that such particles cannot be smoothed out by simple preprocessing such as low-pass filtering. Thus, they can distribute the optical flow of moving objects in time and space. To deal with these issues for matching between frames, we first assumed that particle-like patterns and moving objects have properties of fluidity and rigidity, respectively. The image brightness change and motion smoothness between frames can constrain the estimated optical flow of a moving object. However, a local large brightness change caused by the above factors violates such constraints. Thus, on the basis of a statistical approach, we have developed a robust optical flow estimation method by adding a locally parallel flow constraint. Estimated flow is used to count the number of multiple moving objects by a clustering method, which is applied starting with a large number of centroids. Centroids are iteratively merged within a certain distance until converged. Experimental results show that our method outperforms previous methods, thus

validating our method.

Archiving and Preservation of Media Content Using MPEG-A

N. Harada, Y. Kamamoto, T. Moriya, Hendry, H. Sabirin, and M. Kim

IEEE Multimedia, Vol. 17, No. 4, pp. 94–99, 2010.

This article describes a standardized packaging format for digital media files. Archiving is accomplished through a hierarchical file structure and rich contextual information, while preservation is realized by enabling portability in the structure and file attributes. Advanced functionality, such as usage governance, is supported by the packaging format.

Fast Sensing Using Single-electron Stochastic Resonance in Si Nano-wire Transistors

K. Nishiguchi and A. Fujiwara

Proc of the 23rd International Microprocesses and Nanotechnology Conference (MNC 2010), Kokura, Kyushu, Japan, 2010.

We demonstrated single-electron-based stochastic resonance (SR) using nanoscale MOSFETs. The physical nature of shot noise allows fast SR demonstration, which leads to time-division SR operation with one unit instead of multiple network units. This is very useful for high integrability of sensors and for single-shot sensing of quickly moving targets.