spot and algebraic specification, one of the formal specification languages. According to these rules, problems for specifying functional aspect of framework which is composed by connecting components are clarified, and these are shown to be solved by descriptive device and theoretical extension of algebraic specification. Then using these solutions, components of business transaction processing are specified, from which the solutions are evaluated.

*key words: component, application framework, formal specification, algebraic specification*

## A Program Slicing Method Using Lightweight Dynamic Information

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When we try to debug a large program effectively, it is very important to separate a suspicious program portion from the overall source program. Program slicing is a promising technique to extract a program portion; however, it remains difficult issues. Static slicing sometimes produces a large portion of the source program, and dynamic slicing requires unacceptably huge run-time overhead. In this paer, we discuss intermediate semi-dynamic methods between static and dynamic slicing. We propose a slicing methods named dependence-cache slicing. This algorithm has been implemented in our experimental slicing system, and execution data for several sample programs have been collected. The result shows that dependence-cache slice reduces the slice size by about 30–90% from the static slice size, even for programs using arrays, with affordable run-time overhead increase. These slicing methods will be important features for effective debugging environments.

*key words: static slice, dynamic slice, execution overhead, dependence-cache slicing*

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## D-I
## LETTERS Information Processing

### On the Treatment of User's Retrieval Intention for the Effective Document Browsing

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The procedure named WiB1, which utilizes the relevance judgment for the effective browsing, has been proposed based on the consideration that user's retrieval intention will be multifaceted. We here examine in more detail about the consideration from the viewpoint of the ways of treating the relevance judgement information.

*key words: information retrieval, multifaceted retrieval intention, concept learning, browsing assistant*

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### Rate and Speed of Information Spread over a Web-Like Network

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We investigate the rates and speeds of information spread over topologically different random (RN) and Web-like networks (WN). By a simulation, we found the spread time is proportional to the size of RN; in contrast, it is independent in WN, slightly more edges are needed to spread over the whole.

*key words: information spread, WWW, network topologies, power law, random directed graph*

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## D-II
## PAPERS Pattern Processing

### A Consideration on a Family of q-Normal Distributions

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(Vol.J85-D-II, No.2, pp. 161-173)

In this paper, the noble probability density function, called the $q$-normal distribution, is given by considering Tsallis entropy which is one of the generalized entropies, the first $q$-moment and the second $q$-moment, where the $q$-moment is defined by the moment evaluated by the escort distribution. The $q$-normal distribution determines the specific distribution when the parameter $q$ and its mean and variance are given. This $q$-normal distribution can smoothly connect the various probability density functions. According as the parameter $q$ changes from $-\infty$ to 3, the $q$-normal distribution changes from the uniform distribution with compact support to the uniform distribution with non-compact support, which height is completely 0, via Cauchy distribution, t-distribution and the normal distribution etc. It is shown that the various properties of the $q$-normal distribution and the duality between the $q$-normal distribution and its associ-

ated escort distribution. This duality relation reveals that the $q$-normal distribution can be related with the other $q$-normal distribution. Of course, there exists other distribution family to which the normal distribution belongs. However there is the meaningful difference between such other distribution family and the $q$-normal distributions. The most important property of the $q$-normal distributions is that every $q$-normal distribution has its own entropy subjected to the parameter $q$ and maximizes that entropy, but the other distribution family doesn't have this fundamental property. The $q$-Gabor wavelet is also considered to show the prominent characters of the $q$-normal distribution.

*key words: q-normal distribution, q-expectation, q-moment, escort distribution, q-Gabor wavelet, duality*


## Acoustic Model Adaptation by Selective Training Using 2-Stage Clustering

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(Vol.J85-D-II, No.2, pp. 174-183)

This paper proposes a method of constructing acoustic models from training data clustered in two stages. The first stage generates cluster models from small-scale training data gathered form a target task. The second stage clusters a large-scale database based on the cluster models. In decoding, the best acoustic model is selected from all the acoustic models based on the GMM likelihood using some initial frames of an input utterance. Broadcast news transcription experiments showed that the proposed models achieved a word error reduction of 20% and a processing time reduction of 22%, compared with a non-clustered model.

*key words: speech recognition, clustering, acoustic model adaption, GMM, broadcast news*


## An Automatic Timing Detection Method Using Word Spotting and Dynamic Programming for Superimposing Captions in Television Programs

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This paper describes an automatic timing detection method for superimposing captions in television programs. Speech in the programs is characterized by overlapped background noise and the length of the programs. Those problems were solved by applying dynamic programming with four scores: the likelihood by word spotting, the time order of sentences, the ratio between the spotted sentence length and the estimated one, and the likelihood of speech. A detection rate of 99.0% was obtained for an allowable timing error of one second on documentary programs. It was shown that the proposed method is practical.

*key words: timing detection for superimposing captions, automatic generation of captions, word spotting, HMM, dynamic programming*


## Automatic Determination Algorithm for Optimum Number of States in Discrete-Type HMnet

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(Vol.J85-D-II, No.2, pp. 193-199)

We have proposed a construction algorithm of an HMnet-based language model. Traditional construction algorithms did not propose how to determine an optimum number of states of an HMnet good for test set. Therefore, it is necessary to execute preliminary experiments for determination of number of states because the optimum number of states is changed by various factors. In this paper, we proposed an automatic determination method. For each number of states, the proposed algorithm can estimate the likelihood for test samples using training samples. Experimental results showed the proposed algorithm could determine optimum number of states.

*key words: discrete-type HMnet, NL-HMnet, MDL, auto-*