A Semantic Associative Computation Method for Automatic Decorative-Multimedia Creation with "Kansei" Information

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Abstract

In the design of multimedia systems, one of the important issues is how to deal with "Kansei" of human beings. The concept of "Kansei" in Japanese includes several meanings on sensitive recognition, such as "impression," "human senses," "feelings," "sensitivity," "psychological reaction" and "physiological reaction."

This paper presents a new concept of "automatic decorative-multimedia creation" and a semantic associative computation method. This method realizes automatic main-media decoration with dynamic sub-media data selection for representing main-media as decorative multimedia. The aim of this method is to create a new field of "automatically decorative media art" with "semantic associative computing."

This paper defines an "automatic media decoration model" with semantic spaces and media-decoration functions. Automatic media decoration is realized by applying the Mathematical Model of Meaning (MMM) to a media-transmission space for computing semantic correlations between main-media objects and sub-media.

The process of this dynamic media decoration method consists of the following functions:

(1) Extraction of semantic "Kansei" features of "main-media object," such as music, image and video.
(2) Mapping of the main-media object onto the media-transmission space between main-media and sub-media.
(3) Semantic associative computation of correlations between the main-media object and the features of the sub-media space by MMM, and creating a vector of the main-media object with the features of the sub-media space.
(4) Mapping of the vector of the main-media object to the sub-media space, and semantic associative computing between the main-media object and sub-media data.
(5) Semantic ranking of sub-media objects as the result of the semantic associative computation, and selects one of the sub-media objects with high correlation values to the target main-media object.
(6) Automatic rendering of the target main-media object with the selected sub-media object for decorating the main-media presentation.

This paper shows several significant applications of the semantic associative computation method for "automatic decorative media creation."

1 Introduction

In the field of multimedia systems, the concept of "Kansei" is related to data definition and data retrieval with "Kansei" information for multimedia data, such as images, music and video. The important subject is to retrieve images, music and stories dynamically according to the user's impression given as "Kansei" information.

The field of "Kansei" information was originally introduced as the word "aesthetics" by Baumgrarten in 1750. The aesthetics of Baumgrarten had been established and succeeded by Kant with his ideological aesthetics [5]. In the research field of multimedia database systems, it is becoming important to deal with "Kansei" information for defining and extracting media data according to impressions and senses of individual users. In the field of "Kansei" database systems, the essential functions for dealing with "Kansei" in database systems can be summarized as follows:

(1) Defining "Kansei" information to media data (metadata definition for media data).
(2) Defining "Kansei" information for user's requests (metadata definition for user's requests (user's keywords) with "Kansei" information).
(3) Computing semantic correlations between "Kansei" information of media data and a user's request
(4) Adapting retrieval results according individual variation and improving accuracy of the retrieval results by applying a learning mechanism to metadata of media data (learning mechanism for metadata).

There are several research projects to realize these functions. In the design of the "Kansei" information for media data, the important issues are how to define and represent the metadata of media data and how to search media data dynamically, according to user's impression and media data contents. Creation and manipulation methods of metadata for media data have been summarized in [5], [20].

As a semantic associative search method for multimedia database systems dealing with "Kasei" information, we have proposed the Mathematical Model of Meaning (MMM) [10], [11], [13].

The MMM is a basic model for realizing a semantic associative search method with context recognition mechanisms for computing semantic distances and correlations between different media data, information resources and words. One of the important applications, we have presented a semantic associative search system for images [11], [14].

The important feature of this model is that the data objects in databases are mapped into an orthogonal semantic space and extracted by a semantic associative search mechanism [11], [14]. This method realizes the computational machinery for recognizing the meaning of a keyword according to a context (context words) and obtaining the related data objects to the keyword in the given context.

The MMM is applied to a semantic image and music search, as a fundamental framework for representing the metadata and searching images and music. The main feature of this model is that the semantic associative search is performed unambiguously and dynamically in the orthogonal semantic space. This space is created for computing semantic equivalence or similarity between user's impression and image's metadata items which represent the features of image data.

We point out that context recognition is essentially needed for multimedia information retrieval. The meaning of information is determined by the relation between contents and the context. The machinery for realizing dynamic context recognition is essentially important for multimedia information acquisition.

The advantages and original points of the MMM are as follows:

(1) The semantic associative media search based on semantic computation for words is realized by a mathematical approach. This media search method surpasses the search methods which use pattern matching for associative search. Users can use their own words for representing impression and data contents for media retrieval, and do not need to know how the metadata of media data of retrieval candidates are characterized in databases.

(2) Dynamic context recognition is realized using a mathematical foundation. The context recognition can be used for obtaining multimedia information by giving the user's impression and the contents of the information as a context. A semantic space is created as a space for representing various contexts which correspond to its subspaces. A context is recognized by the computation for selecting a subspace.

Several information retrieval methods, which use the orthogonal space created by mathematical procedures like SVD (Singular Value Decomposition), have been proposed. The MMM is essentially different from those methods using the SVD (e.g. the Latent Semantic Indexing (LSI)) method [3]. The essential difference is that our model provides the important function for semantic projections which realizes the dynamic recognition of the context. That is, the context-dependent interpretation is dynamically performed by computing the distance between different media data, information resources and words. The context-dependency is realized by dynamically selecting a subspace from the entire orthogonal semantic space, according to a context. In MMM, the number of phases of contexts is almost infinite (currently 2^{2000} in the general English word space and 2^{180} in the color-image space, approximately). For semantic associative computations of "Kansei" information in MMM, we have constructed several actual semantic spaces, such as the general English-word space in 2115 dimensions, the color-image space in 183 dimensions, and music space in 8 dimensions in the current implementations.

We have applied this method to several multimedia database applications, such as image and music database search by impressionistic classification. We have introduced these research results in [11], [14] and [15]. Through these studies, we have created a new meta-level knowledge base environment by applying those methods to data retrieval, data integration and data mining [12], [16].

A learning mechanism is very important for database systems dealing with "Kansei" information to adapt search results according to individual variation and to improve accuracy of the search results. Generally, multimedia database systems dealing with "Kansei" information might not always select accurate and appropriate media data from databases, because the judgment of accuracy for the search results is highly related to individual variation. In the learning process, if inappropriate search results for a request are extracted by the system, accurate data items which must be the search results are specified as suggestions. Then, the learning mechanism is applied to the system to extract the appropriate retrieval results in subsequent requests. We have designed several database systems dealing with "Kansei" information for searching and extracting media data according to the user's impression and the image's contents. Those systems provide learning mechanisms for supporting adaptability to individual variations in "Kansei" [11], [14].

In this paper, we present a new concept of "automatic decorative media creation" and a semantic associative computation method realizing automatic sub-media data selection and main-media decoration for representing a main-media object as decorative multimedia, as shown in **Figure 1**.

The important features of this method are summarized as follows:

(1) Main-media representation is automatically decorated by sub-media data with the semantic associative computation between a main-media object and sub-media data. The "Kansei" information of the main-media object is used as a context to compute semantic association and selection to the sub-media data in MMM.

(2) Each main-media object is mapped in the media-specific semantic space corresponding to the

main-media, and then, it is mapped onto the related sub-media space by using semantic associative computation in MMM, through a media-transmission space. Two semantic spaces and a media-transmission space are used for computing semantic correlations between different media data in our automatic decorative multimedia creation.

This method will lead to various applications for decorative multimedia creation as follows:

(A-1) "decorative music rendering with images, according to the impression and "Kansei" of the music,

(A-2) "decorative video rendering with color visualization according to impression transition of a video story",

(A-3) "decorative text (novel) representation with the appropriate fonts, according to the impression of a story.

(A-4) "decorative image presentation with music according to the impression and "Kansei" of the image,

(A-5) "automatic decoration of a room with appropriate room lighting, according to the situation and context of the room,

(A-6) "automatic Web-page decoration with appropriate fonts and colors according to the impression of the page content.

In this paper we show several significant applications of the semantic associative computation method for "automatic decorative media creation" related to (A-1) and (A-2).

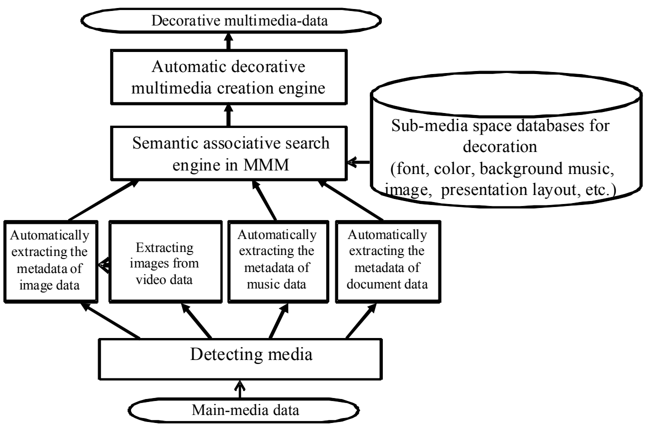


Figure 1: The overview of automatic decorative multimedia creation

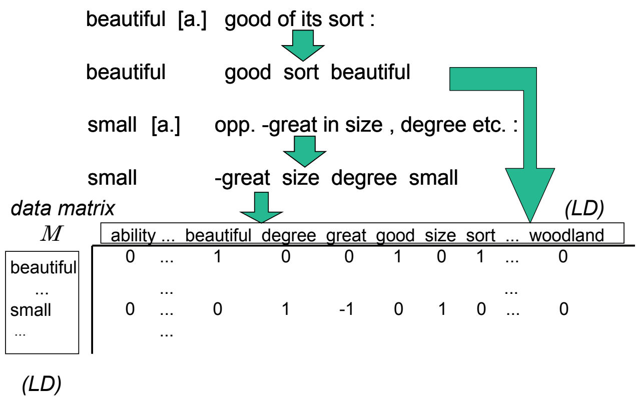
2 The Semantic Associative Search Method

In this section, the outline of the Mathematical Model of Meaning (MMM) is briefly reviewed. This model has been presented in [10], [11] and [13] in detail.

In the Mathematical Model of Meaning, an orthogonal semantic space is created for realizing the semantic associative search. Retrieval candidates and queries are mapped onto the semantic space. The semantic associative search is performed by calculating correlations of the retrieval candidates and queries on the semantic space.

2.1 Creation of the semantic space

To create the semantic space, a dictionary is selected and utilized. We refer to the basic words that are used to explain all the vocabulary entries in the dictionary as features [1]. For example, in a dictionary, an entry term "beautiful" is explained by the features "good," "sort," "beautiful" etc. as shown in **Figure 2**.



•Items: Basic words in *Longman Dictionary of Contemporary English (LD)* (2115words)

Figure 2: The matrix M for semantic space creation in MMM (The matrix is constructed based on a dictionary.)

When m terms are given as the vocabulary entries in the dictionary and n features are utilized to explain all these terms, an m by n matrix $\boldsymbol{M}$ is constructed for the space creation. Each term in the matrix $\boldsymbol{M}$ is characterized by the n features.

For example, the term "beautiful" is characterized by the features "good," "sort," "beautiful," etc. When a feature, for example, "good," is used for explaining the term "small," the value of the entity at the row of "beautiful" and the column "good" is set to "1" as shown in **Figure 2**.

In the case of "small," for example, in Figure 2, the term is characterized by the features "great," "size," "degree," etc. When a feature, for example, "degree," is used for explaining the term "small," the value of the entity at the row of "small" and the column "degree" is set to "1". If a feature is used as the negative meaning, for example, the feature "great," the column corresponding to this feature is set to the value "-1." If features are not used to explain terms, the columns corresponding to those features are set to "0." As the features "ability" and "beautiful" are not used to explain the term "small," the characterized value of these two features is "0."

By using this matrix **M**, the orthogonal space is created as the semantic space based on a mathematical method.

2.2 An overview of the Mathematical Model of Meaning

In the Mathematical Model of Meaning, an orthogonal semantic space is created for semantic associative search. Retrieval candidates and queries are mapped onto the semantic space. The semantic associative search is performed by calculating the correlation of the retrieval candidates and the queries on the semantic space in the following steps:

(1) A context represented as a set of impression words is given by a user, as shown in **Figure 3 (a)**..

(2) A subspace is selected according to the given context as shown in **Figure 3 (b)**.

(3) Each information resource is mapped onto the subspace and the norm of A1 is calculated as the correlation value between the context and the information resource, as shown in **Figure 3 (c)**.

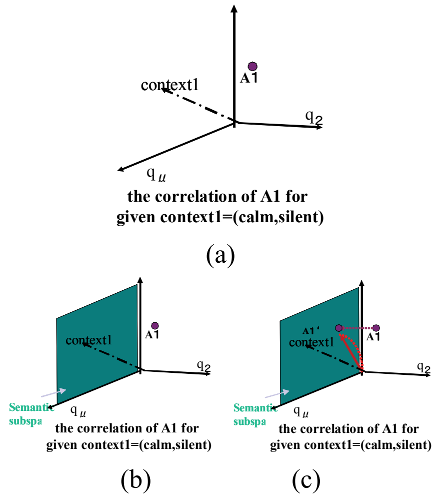


Figure 3: Semantic associative search in MMM

In MMM, the semantic interpretation is performed as projections of the semantic space dynamically, according to contexts, as shown in **Figure 4**.

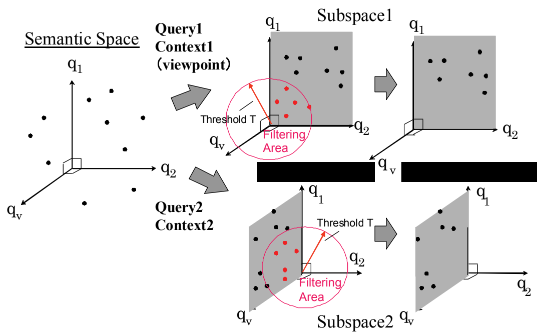


Figure 4: Semantic interpretation according to contexts in MMM

2.3 Metadata structures in MMM

In the MMM, an orthogonal semantic space is defined and information resources are mapped onto the space for computing semantic correlations between associated information resources according to various contexts.

To compute semantic correlations, context words that represent the user's impression and data contents are given as a context. According to these context words, a "semantic subspace" is selected dynamically. Then, the most related information resource to the context is extracted by computing semantic correlations in the selected semantic subspace.

Metadata items are classified into three different kinds. The first kind of metadata items is used for the creation of the orthogonal semantic space, which is used as a search space for semantic associative search. These data items are referred to as "data-item for space creation."

The second kind of metadata items is used as the metadata items of the information resources, which are the candidates for semantic associative search. These metadata items are referred to as "metadata for information resources."

The third kind of metadata items is used as context words, which represent user's impression and data contents in semantic associative search. These metadata items are referred to as "metadata for contexts."

The metadata structures in the MMM are summarized as follows:

(1) Creation of the semantic space:

To provide the function of semantic associative search, basic information on m data items ("data-items for space creation") is given in the form of a matrix. Each data item is provided as fragmentary metadata which are independently represented one another. No relationship between data items is needed to be described. The information of each data item is represented by n features as n-dimensional vector. The m basic data items are given in the form of an m *by* n matrix $\boldsymbol{M}$. For given m basic data items, each data item is characterized by n features. Then, each column of the matrix is normalized by the 2-norm in order to create the matrix $\boldsymbol{M}$.

The eigenvalue decomposition of $\boldsymbol{M}^T\boldsymbol{M}$ is computed.

$$M^T M = Q \begin{bmatrix} \lambda_1 & & & & & \\ & \ddots & & & & \\ & & \lambda_\nu & & & \\ & & & 0 & & \\ & & & & \ddots & \\ & & & & & 0 \end{bmatrix} Q^T, \; 0 \le \nu \le n.$$

The orthogonal matrix $\boldsymbol{Q}$ is defined by

$$Q = (q_1, q_2, \cdots, q_n)^T.$$

We call the eigenvectors "semantic elements." Here, all the eigenvalues are real and all the eigenvectors of $\{q_1, q_2, \cdots, q_\nu\}$ are mutually orthogonal because the matrix $\boldsymbol{M}^T\boldsymbol{M}$ is symmetric.

The orthogonal semantic space *MDS* is created as a linear space generated by linear combinations of $\{q_1, q_2, \cdots, q_\nu\}$. We note that $\{q_1, q_2, \cdots, q_\nu\}$ is an orthogonal basis of *MDS*.

The number of the semantic elements is 2^ν, and accordingly it implies that 2^ν different phases of meaning can be expressed by this formulation.

(In this space, a set of all the projections from the orthogonal semantic space to the invariant subspaces (eigen spaces) is defined. Each subspace represents a phase of meaning, and it corresponds to a context.)

(2) Representation of information resources and contexts in n-dimensional vectors:

Each of the information resources is represented in the n-dimensional vector whose elements correspond to n features used in (1). These vectors are used as "metadata for information resources". The information resources are the candidates for semantic associate search in this model. Furthermore, each of context words, which are used to represent the user's impression and data contents in semantic associative search, is also represented in the n-dimensional vector. These vectors are used as "metadata for contexts."

2.4 The outline of semantic associative search in MMM

The outline of the MMM is expressed as follows:

(1) A set of m words is given, and each word is characterized by n features. That is, an m by n matrix $\boldsymbol{M}$ is given as the data matrix.

(2) The correlation matrix $\boldsymbol{M}^T\boldsymbol{M}$ with respect to the n features is constructed from the matrix $\boldsymbol{M}$. Then, the eigenvalue decomposition of the correlation matrix is computed and the eigenvectors are normalized. The orthogonal semantic space ***MDS*** is created as the span of the eigenvectors which correspond to nonzero eigenvalues.

(3) Context words are characterized by using the n features and representing them as n-dimensional vectors.

(4) The context words are mapped into the orthogonal semantic space by computing the Fourier expansion for the n-dimensional vectors.

(5) A set of all the projections from the orthogonal semantic space to the invariant subspaces (eigen spaces) is defined. Each subspace represents a phase of meaning, and it corresponds to a context or situation.

(6) A subspace of the orthogonal semantic space is selected according to the user's impression expressed in n-dimensional vectors as context words, which are given as a context represented by a sequence of words.

(7) The most correlated information resources to the given context are extracted in the selected subspace by applying the metric defined in the semantic space.

3 Semantic Associative Search for Image Media

The MMM can be used to realize a semantic associative search system for image media.

The basic function of semantic associative search is provided for context dependent interpretation. This function performs the selection of the semantic subspace from the semantic space. When a sequence s` of context words for determining a context is given to the system, the selection of the semantic subspace is performed. This selection corresponds to the recognition of the context, which is defined by the given context words. The selected semantic subspace corresponds to a given context. The metadata item for the most correlated image to the context in the selected semantic subspace is extracted from the specified image data item set. Semantic associative search is performed by the following procedure:

1. When a sequence of the context words for determining a context (the user's impression and the image's contents) are given, the Fourier expansion is computed for each context word, and the Fourier coefficients of each context word with respect to each semantic element are obtained. This corresponds to seeking the correlation between each context word and each semantic element.
2. The values of the Fourier coefficients for each semantic element are summed up to find the correlation between the given context words and each semantic element.
3. If the sum obtained in the step 2 in terms of each semantic element is greater than a given threshold, the semantic element is employed to form the semantic subspace. This corresponds to recognizing the context which is determined by the given context words.
4. By using the norm calculation as a metric in the semantic subspace, the metadata item for the image with the maximum norm is selected among the candidate metadata items for images in the selected semantic subspace. This corresponds to finding the image with the greatest association to the given context.

4 An automatic media-decoration model

In this section, we present a new concept of "automatic decorative multimedia creation" by applying the MMM to automatic sub-media data selection for decorating a main-media object. To realize this concept, we define an "automatic media decoration model" with semantic spaces and media-decoration functions. The overview of this model is shown in **Figure 5**.

4.1 Basic semantic spaces and a media-transmission space

We define two semantic spaces and a media-transmission space (matrix) for computing semantic correlations between main-media objects and sub-media.

(1) M-Space (Main-media semantic space)

Each main-media object or each impression word expressing impression of a main-media object is defined as an M-Space vector with m main-media-features.

(2) S-Space (Sub-media semantic space):

Each sub-media object or each impression word expressing impressions in a sub-media object is defined as an S-Space vector with n sub-media-features. In this space, various sub-media objects are mapped in advance, as retrieval candidates, in S-Space for decorating the main-media object.

(3) MS-Space (Main-media and Sub-media transmission space):

Each of m features of Main-media is expressed in the n features of Sub-media in the MS space. The MS-space is defined as a (m, n) matrix for transmitting an M-space vector into its corresponding S-space vector.

4.2 Basic functions for media decoration:

In this method, basic functions for decoration of a main-media object with sub-media are defined:,

Step-1: maps a target main-media object onto the M-Space as the M-space vector for the decoration target, by expressing the object as an m-dimensional vector with the m features.

Step-2: computes correlation values between the M-space vector and each sub-media feature in the MS-Space (Main-media and Sub-media transmission space) by the Mathematical Model of Meaning (MMM), and creates an

S-Space vector (target-S-Space vector) as the transmitted vector of the main-media object.

Step-3: maps the target S-Space vector expressing the main-media object onto the S-Space.

Step-4: executes the semantic associative search processes by the MMM between the target S-Space vector and the candidate sub-media objects which have been mapped onto the S-Space in advance. (In MMM, the target S-Space vector is mapped as a context vector in S-Space, and candidate sub-media objects are mapped as retrieval candidates in S-Space.)

Step-5: outputs semantic ranking of sub-media objects as the result of our semantic associative search processes, and selects one of the sub-media objects with high correlation values to the target main-media object.

Step-6: renders the target main-media object with the selected sub-media object for decorating the main-media presentation with the selected sub-media data.

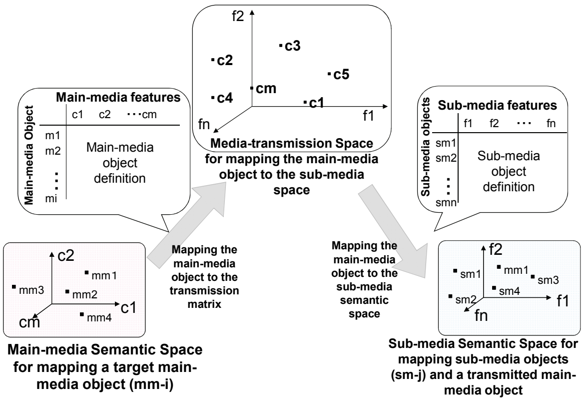


Figure 5: Automatic decorative multimedia creation by the semantic associative computation method

5. Applications of "automatic decorative multimedia creation"

In this section, we present several applications of the automatic decorative multimedia creation by our semantic associative computation method.

(1) Music decoration with images:

This application is automatic "music decoration with images," as shown in **Figures 6 and 7**. This decoration process consists of 6 steps.

Step-1: generates the metadata (in a form of a vector in the "music semantic space") of music-media object, as a main-media object.

Our research project has proposed several automatic impression metadata generation methods for music [8], [21]. In this step, we use the metadata generation method to create impression metadata of music data [8]. This method applies the music psychology by K. Hevner [6], [7] to automatic extraction of music impression.

Step-2: generates the metadata (in a form of a vector in the "image semantic space") of each image-media object in the image collection, as the collection of sub-media object.

Our research project has also proposed several automatic impression metadata generation methods for images. In this step, we apply one of the metadata generation methods to create metadata of image data [11], [14].

Step-3: maps the metadata of the music-media object to the metadata in the image-media space, by using the MS-space ("Main-media and Sub-media transmission space").

In this step, we apply a main-media and sub-media transformation space by using the relationships between the features of music and those of images in colors, which are created by artists and psychologists. This space consists of the correlations between the impression words of music and images.

Step-4: calculates semantic correlations between the music-media object and image-media objects in the "image semantic space."

In this step, we apply the MMM to calculate the impression correlation between music and images.

Step-5: outputs the semantic ranking of image-media objects as the result of our semantic associative computation process, and selects image-media objects with high correlation values to the target music-media object.

This step outputs the correlation values of image data in ascending order.

Step-6: renders the music-media object with the selected images as the music-media decorated with images.

This step is a rendering process for music decorated with images.

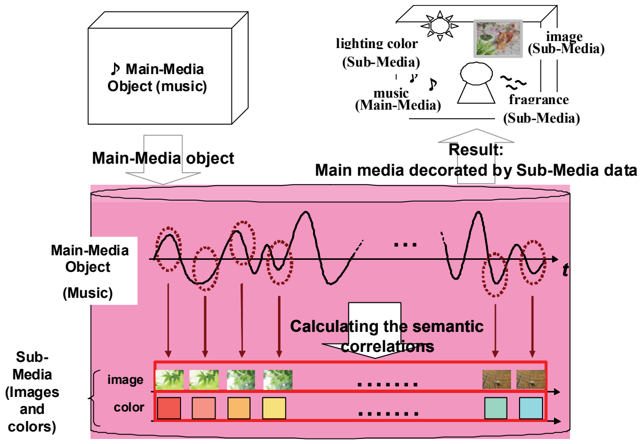


Figure 6: Music decoration with images by automatic decorative multimedia creation

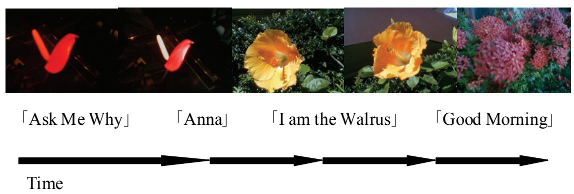


Figure 7: Decoration for music-collections (the Beatles music collection) with images

(2) Color-based impression analysis for video and decoration with "Kansei" information

We have designed an experimental system for video analysis in terms of "Kansei" information expressed by the color-impression, as shown in **Figure 8**. This system realizes a color-based impression analysis for video-media. This system creates a story-line in impressions by analysing colors in each frame composing a video stream [19].

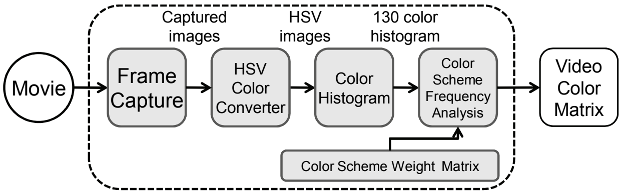


Figure 8: Video analysis in colors for decorating video with "Kansei" information

In this system, we have created the color-impression space using 120 chromatic colors and 10 monochrome colors defined in the "Theory of Colours" [4] and "Color Image Scale" [17] based on the Munsell color system. We used 183 words, which are also defined as cognitive scales of colors in the Color Image Scale, as impression words in the process of construction of color-impression space, shown in **Figure 9**. To generate a color histogram of each frame composing video, we used 130 colors in **Figure 10**, the same number of colors used in the color-impression space. This system converts RGB values to HSV values per pixel of each image, clusters them into the closest color of 130 colors, and calculates the percentage of each color to all pixels of the image [18]. The 183 color schemas are defined as color-impression variations by using the 130 basic color features, as shown in **Figure 9**. By correlation calculations between 180 color schemas and 130 basic colors, this system extracts the color-impression for each frame composing a video, and creates a sequence of color-impressions of the video along the timeline, as shown in **Figures 11, 12, 13** and **14**.

In the color-impression space used as the main-media space, this system creates a sequence of color-impressions of the video and applies it to decorate the video with sub-media, such as music or images, by using the semantic associative computation method.

130 Basic Colors

183 Color-Schemas	R/V	R/S	R/B	R/P	…	N/9.5
cs1	1	0	0	0	…	0
cs2	0.4	0	0	0	…	0
cs3	0	0	0	0	…	0
…	…	…	…	…	…	…
cs183	0	0	0	0.6	…	0

Figure 9: Image-media features in 183 color schemas in impressions related to 130 color variations

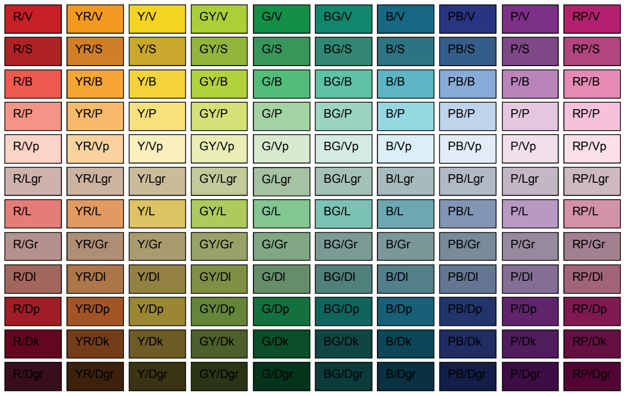


Figure 10: Munsell 130 Basic Colors for extracting color schemas in impressions

183 Color-Schemas

Time	cs1	cs2	cs3	…	cs_m
t1	0.2	0.4	0.2	…	0.1
t2	0.1	0.1	0.0	…	0.2
t3	0.1	0.3	0.25	…	0.4
…	…	…	…	…	…
t_n	0.43	0.33	0.11	…	0.04

Figure 11: The video-media story expressed in color schemas along the timeline

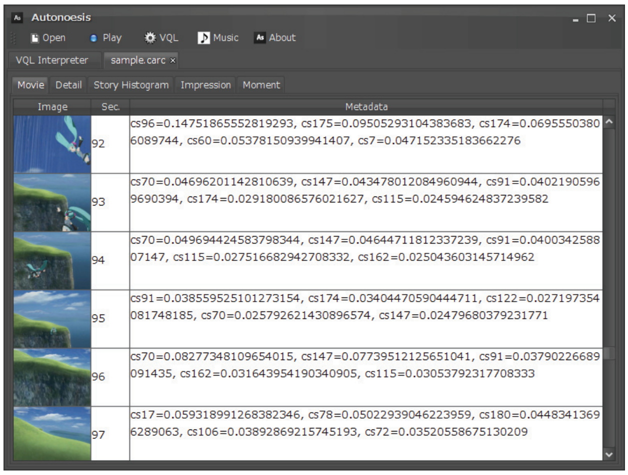


Figure 12: Video analysis for expressing 183 color schemas in each frame composing the video

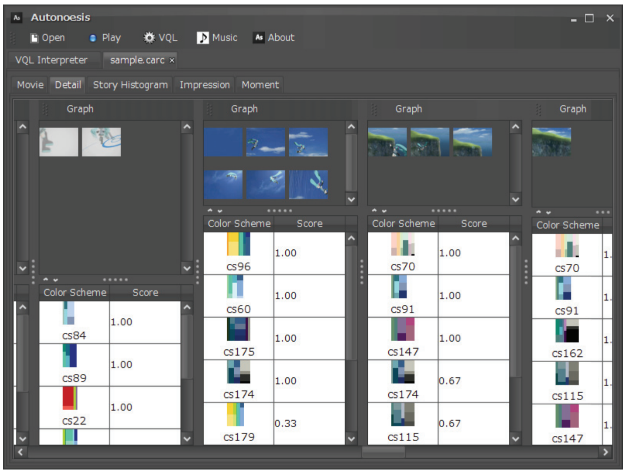


Figure 13: Video analysis with 183 color schemas in each scene

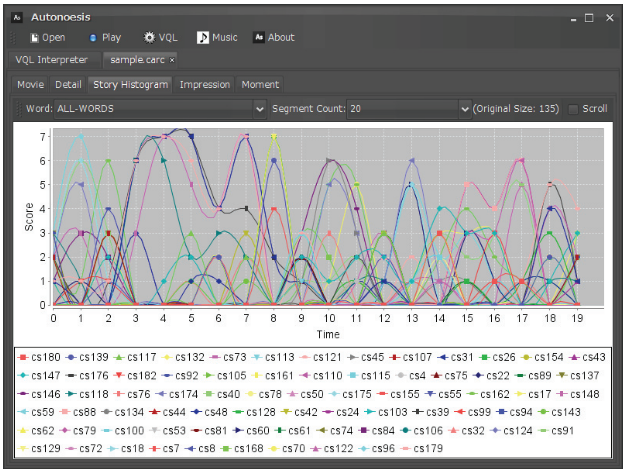


Figure 14: Video-media decoration with impression-transition in color schemas along the timeline

(3) Music-media decoration with tonality-transition in colors

The experimental system realizes music-media decoration with colors along tonality-transition in music. This system renders music with the visualization of tonality-transition in colors [9]. **Figure 15** shows a music-media decoration with tonality-transition in colors for 15 music compositions, J.S.Bach's Invention No.1—No.15. The system analyses a MIDI file as a data source for each music composition and generates music features extracted by tonality-analysis, musical segment analysis and tempo analysis. For analysing tonality transition of music, we have applied the Krumhansl-Schmuckler algorithm to MIDI files as a tonality-finding method. **Figure 16** represents the tonality transition of music "Sarabande" in colors. Those music features of tonality are automatically extracted and mapped to the music-media space along the timeline. Then, our semantic associative computation method is applied to music rendering for decorating it with colors.

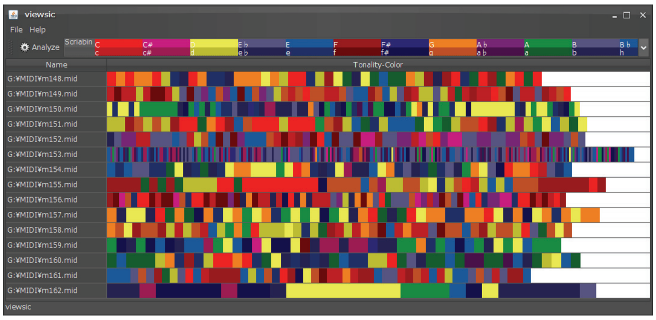


Figure 15: Music-media decoration for J.S.Bach's Invention No.1—No.15 with tonality-transition in colors along the timeline

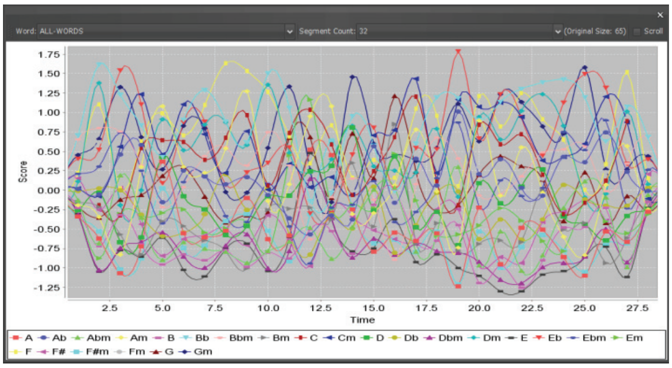


Figure 16: Music-media decoration with tonality transition of "Sarabande" in colors along the timeline

5 Conclusion

In this paper, we have presented a new concept of "automatic decorative multimedia creation" and a semantic associative computation method. This method realizes automatic main-media decoration with sub-media data selection for representing a main-media object as decorative multimedia.

We have reviewed the Mathematical Model of Meaning (MMM) applied to automatic decorative multimedia creation as a basic model for semantic associative computing for multimedia creation. This model is used as a basic computational model for computing semantic correlations between different media data with context computation mechanisms.

This paper has also defined an "automatic media decoration model" with semantic spaces and media-decoration functions. This model defines several functions for realizing automatic decorative multimedia creation by semantic associative computations for images, music and video.

We have implemented several experimental decorative multimedia creation systems for music, images and video media to clarify the feasibility of "automatic decorative multimedia creation" and a semantic associative computation method. As our future work, we realize automatic decorative multimedia creation environments for various application fields. We also create an on-the-fly automatic decorative multimedia creation system for dynamic video representation decorated with various media data.

Acknowledgments
We would like to thank Prof. Takashi Kitagawa (University of Tsukuba) as a co-designer of the Mathematical Model of Meaning (MMM). We would also like to thank our MDBL project members in Keio University for valuable experiments in multimedia database systems.

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