

# Media Processing Technologies for Affective Digital Marketing

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The growing use of smartphones and social media is complicating and diversifying the purchasing behaviors of customers. They can now access products and services at various customer contact points such as physical stores and e-commerce sites. Furthermore, digital marketing through smartphones that reflects customer concerns and recommends products that suit individual customers is growing steadily. Of particular interest is the growing use of omni-channel retailing, which enables customer data collected at various contact points to be used collectively, thereby improving service throughout the channels. Given this background, Fujitsu Laboratories is researching "Affective Digital Marketing," which estimates the customer's state of mind (concerns, satisfaction, etc.), motivates the customer in accordance with his or her stage of purchasing and/or state of mind, and optimizes the customer's experience. In this paper, we explain the technical features of three media processing technologies that support Affective Digital Marketing: "Advertising Copy Creation Assistive Technology," "Touch Emotion Analysis Technology," and "Speech Emotion Analysis Technology." We also introduce applied examples in the field of digital marketing.

## 1. Introduction

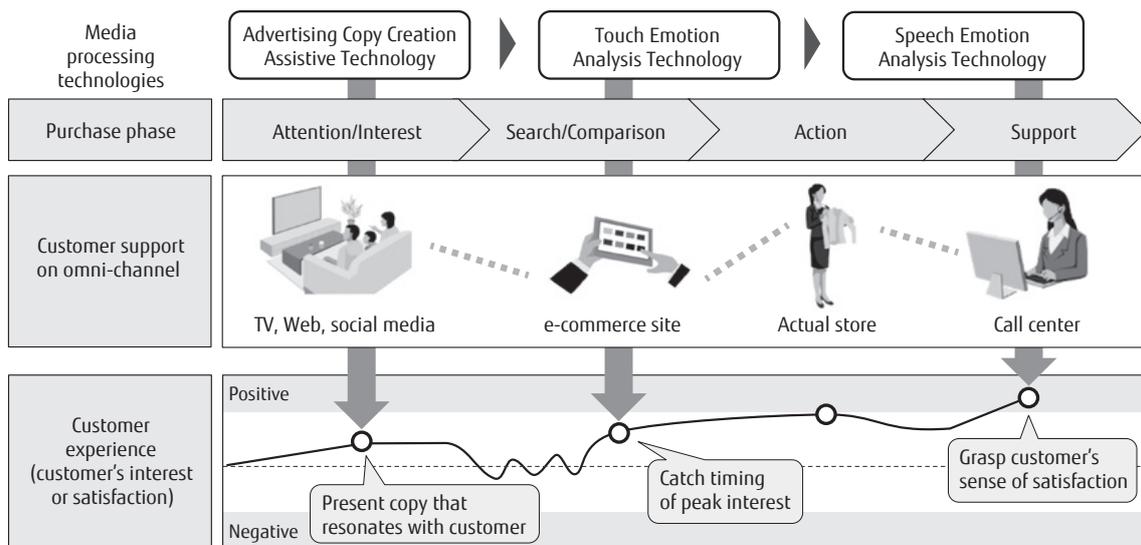
Consumer purchasing behavior is becoming more complex and diversified due to the expanding use of smartphones and social media. Customers can gain information on products or services and then experience and compare them all at customer contact points such as actual stores, e-commerce sites (online malls), company sites, TV shopping channels, and via direct mail and social media.

Moreover, advanced countries are now full of 'things,' and a high standard of customer experience is demanded in addition to the value of the products and services themselves. Therefore, digital marketing, which offers an effective customer approach, is attracting attention. This strategy catches the customer's interests and preferences through smartphones and computers, meaning that tailored recommendations can be offered at appropriate times. In addition, omni-channel retailing enables customer data provided at various contact points to be used optimally to improve services across all channels.

Fujitsu Laboratories is aiming to achieve "Affective

Digital Marketing," i.e., the continuous capture of affective information such as customers' interests and satisfaction levels that have not previously been obtained and that contribute to creating an optimized customer experience at various contact points of the omni-channel through targeted, tailored, and timely approaches.

For example, as shown in **Figure 1**, customer interest can be further aroused in the purchase phase for a customer who browses the web, shows interest in a product, and is then presented with pertinent advertising copy. Moreover, the purchasing activity can be further promoted and customer satisfaction improved in the purchase phase if a customer is searching for similar products on an e-commerce site and is offered a comparison facility in a timely manner that enables choosing the product best suited to the customer's needs. In addition, the sense of satisfaction can be further improved for customers in the purchase phase who need support for their purchased product by determining whether the customer is satisfied or dissatisfied on the basis of conversations with the customer and



**Figure 1**  
Overview of Affective Digital Marketing.

implementing appropriate follow-up.

This paper introduces three media processing technologies that support Affective Digital Marketing.

## 2. Advertising Copy Creation Assistive Technology

The first media processing technology that supports Affective Digital Marketing is “Advertising Copy Creation Assistive Technology,” which assists in creating advertising copy that promotes customer purchasing behavior in accordance with the product or service.

### 2.1 Background and problems with conventional technologies

Companies use advertisements, for example web adverts, to promote customer purchasing behaviors. Advertising copy to date has been created manually, but technology that helps to create advertising copy has recently appeared.

Technology that helps to create advertising copy has already been put into practice and automatically generates effective copy that promotes purchasing behavior, such as “Click for Web advertisement” and “Purchase.” The copy creator also corrects the generated copy and then publishes it. The technology generates advertising copy by selecting effective word expressions on the basis of real-life data on advertising effectiveness, such as the click-through rate (CTR)<sup>1)</sup> and

conversion rate (CVR) for word expressions used in common advertising copy, for example, “Only you!” and “You should take this opportunity!” However, the technology does not use information that is feature-specific to the product or service, such as fabric and stitching detail for clothing, so it cannot generate advertising copy that uses expressions describing specific features, such as “superb softness” and “beautiful hand stitching.”

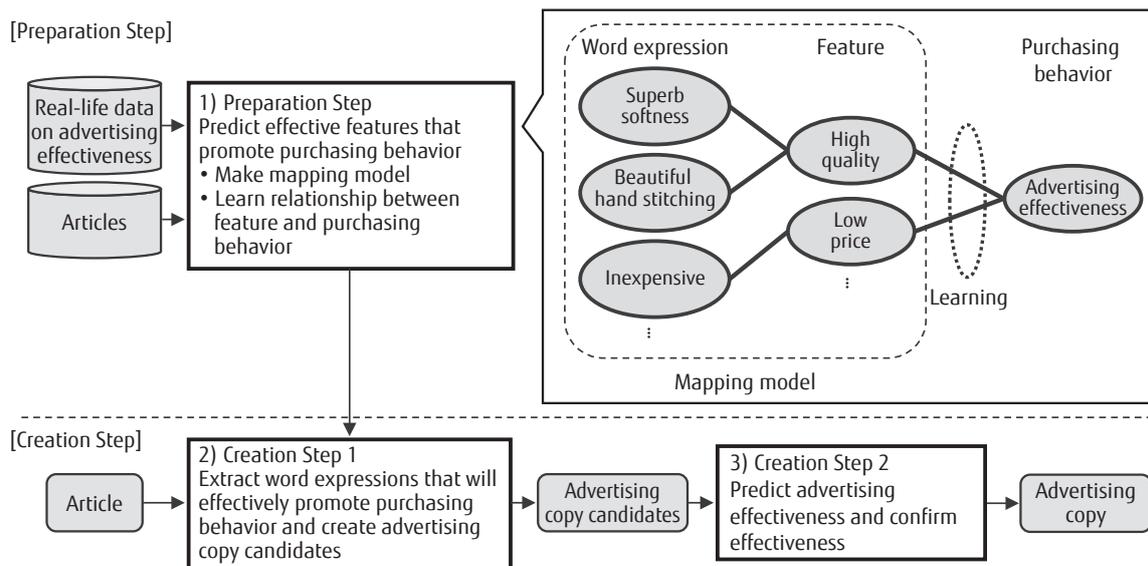
### 2.2 Developed technology

Our Advertising Copy Creation Assistive Technology extracts effective word expressions that represent features specific to the product or service and thus assists in creating advertising copy by using such information alongside real-life data on advertising effectiveness.

**Figure 2** illustrates the process of our technology consisting of a preparation step and two creation steps. The word expressions and features in Figure 2 are used as an example of applying our technology to clothing.

1) Preparation Step: Predict effective features that promote purchasing behavior.

First, the copy creator collects advertising copy published in the past and real-life data on advertising effectiveness related to the product or service in question. It also collects articles from e-commerce and news sites containing information about the product or service. Then, referring to the articles, it lists features specific to the product or service, such as “high quality”



**Figure 2**  
**Process outline of Advertising Copy Creation Assistive Technology.**

and “low price.” It also extracts from the articles word expressions that represent particular features, such as “superb softness” and “amazing price” and constructs a mapping model that relates features to word expressions. Here we assume that a future Fujitsu product provides the agent service for the work done in this preparation step.

Our technology predicts which features will effectively promote purchasing behavior by extracting features represented in past advertising copy using the mapping model and by learning the relationships between the extracted features and the effectiveness of the advertising. In practical terms, our technology extracts features represented in advertising copy by matching past advertising copy and word expressions in the mapping model and tracing features from the word expressions in the mapping model. It also predicts features that promote purchasing behavior via the learned relationships between the extracted features and the advertising effectiveness, thereby identifying the optimum approach. In addition, by using features that promote purchasing behavior regardless of the product or service, our technology helps to create advertising copy that promotes purchasing behavior for any product or service.

2) Creation Step 1: Extract word expressions that will effectively promote purchasing behavior and create advertising copy candidates.

In this step, the copy creator first collects articles containing information specific to the product or service for which advertising copy is required. Our technology uses the mapping model to extract word expressions that represent features that promote purchasing behavior. It is also able to exclude unrepresentative word expressions for better targeted copy.

Let us consider an example in which the copy creator is to create advertising copy for jeans. First, the copy creator collects an article that includes product information. Assume that “high quality” was predicted in the preparation step as a feature that promotes purchasing behavior. Our technology extracts the word expressions “superb softness” and “beautiful hand stitching” related to “high quality” from the mapping model. Furthermore, if “beautiful hand stitching” appears in the article as part of the product information but “superb softness” does not, our technology excludes “superb softness” and retains “beautiful hand stitching.” The copy creator then devises advertising copy candidates on the basis of the extracted word expressions.

3) Creation Step 2: Predict advertising effectiveness and confirm effectiveness

Our technology predicts advertising effectiveness on the basis of the features of the advertising copy candidates created by the copy creator and the relationship between features and purchasing behavior that is learned in the preparation step. The copy creator

confirms the advertising effectiveness and publishes the advertising copy.

### 2.3 Effect of technology

Our technology was applied to the web magazine "FUJITSU JOURNAL,"<sup>(2)</sup> which reports Fujitsu's technical information, etc. The results show that our technology can predict features that promote purchasing behavior, namely clicks for web advertisements, and can extract effective word expressions. The results were obtained by measuring the CTR of web advertisements for articles in FUJITSU JOURNAL. Note that the results were obtained through a Japanese, not an English, experiment, so the word expressions below are in Japanese text with an English translation in parentheses.

We made a mapping model using the articles, and our technology learned the relationships between features and purchasing behavior on the basis of 51 past advertising copies and the corresponding one-month CTR. Then, from among several features in the mapping model, such as "trend" and "universe of life," our technology predicted that "familiar and useful" and "proud" would be effective features.

The following explains the results obtained by revising past advertising copy for an "AC adapter" and a "tablet" in the FUJITSU JOURNAL using our technology. For the AC adapter, our technology extracted "スマホの充電時間 (charging time of smartphone)" as an effective word expression that represents the feature "familiar and useful." For the "tablet" our technology extracted "このこだわりが日本品質 (this is Japanese quality)," "日本が誇る (Japanese pride)," and "国産 (made in Japan)" as effective word expressions that represent the feature

"proud."

We created new advertising copy candidates by revising past advertising copy on the basis of the results. Our technology predicted that the CTR after revision compared to the CTR before revision would be over 1.3 times greater for the AC adapter and 3.9 times greater for the tablet. We then published both advertising copies. **Figure 3** shows English translations of the published copies and the CTRs. For both products, the CTR after revision using our technology was higher: the CTR for the AC adapter was 2.0 times higher, and that for the tablet was 3.1 times higher. These results demonstrate that our technology can predict features that promote purchasing behavior and can extract effective word expressions.

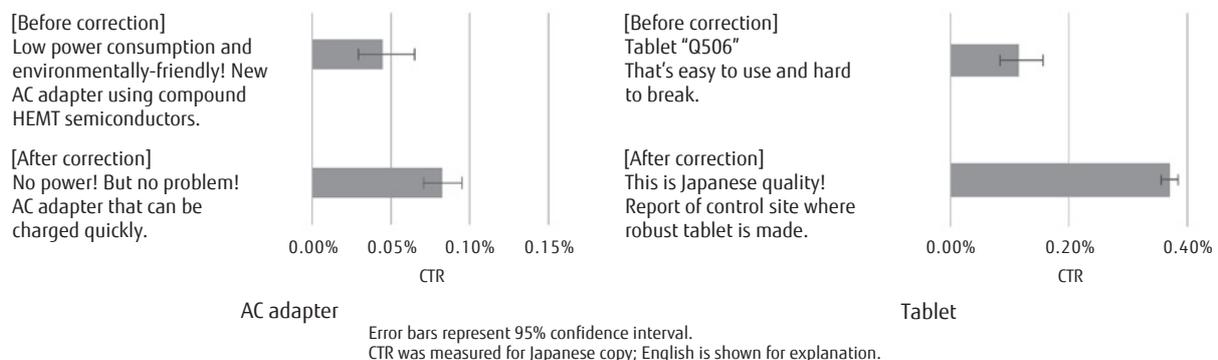
The Advertising Copy Creation Assistive Technology is expected to contribute to improving advertising efficiency in the marketing field. We intend to apply it to advertisements other than those in web magazines offering technical information and confirm that it can assist in creating advertising copy for various products and services that will promote purchasing behavior.

## 3. Touch Emotion Analysis Technology

The second media processing technology that supports Affective Digital Marketing is "Touch Emotion Analysis Technology," which estimates a customer's level of interest and hesitation during touch operations on a smartphone.

### 3.1 Background and problems of conventional technologies

Thanks to the popularization of the smartphone,

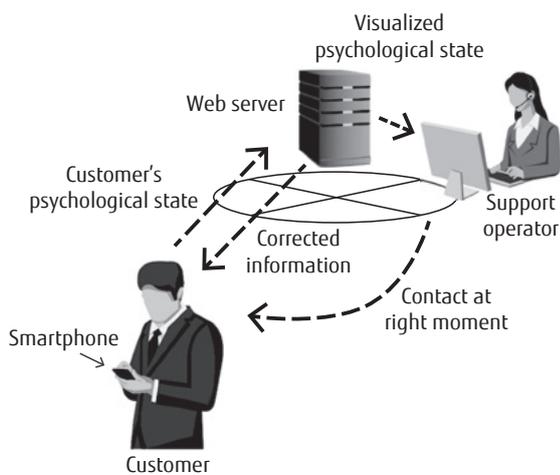


**Figure 3**  
CTR before/after correction.

making purchases via e-commerce sites is commonplace. However, many people leave a site without buying anything.<sup>3)</sup> Therefore, in order to improve e-commerce sites and increase sales, it is important to analyze a customer's psychological state and detect whether he or she is interested in a product and intends to purchase it.

For example, as shown in **Figure 4**, when the system analyzes the psychological state of a customer who visits an e-commerce site and shows an interest in information about a product, it offers an advertisement and service related to the product. In addition, for a customer who shows interest but hesitates and cannot decide whether or not to buy, an assistant approaches, having examined his or her console monitor that displays the customer's mindset or psychological state. This is equivalent to being physically approached in-store in the real world and will likely improve sales.

Conventional technologies estimate the customer's interest and hesitation by considering massive data logs on different operations such as clicks, drags, or flicks and their frequencies in relation to the design of the web page and the location of the click buttons. With this technique, however, the estimated outcome of the customer's interest and hesitation depends on the design of the website. If this design changes, the customer's behavior must be re-evaluated using this same technique. In addition, for a webpage showing news content or product information that has no click

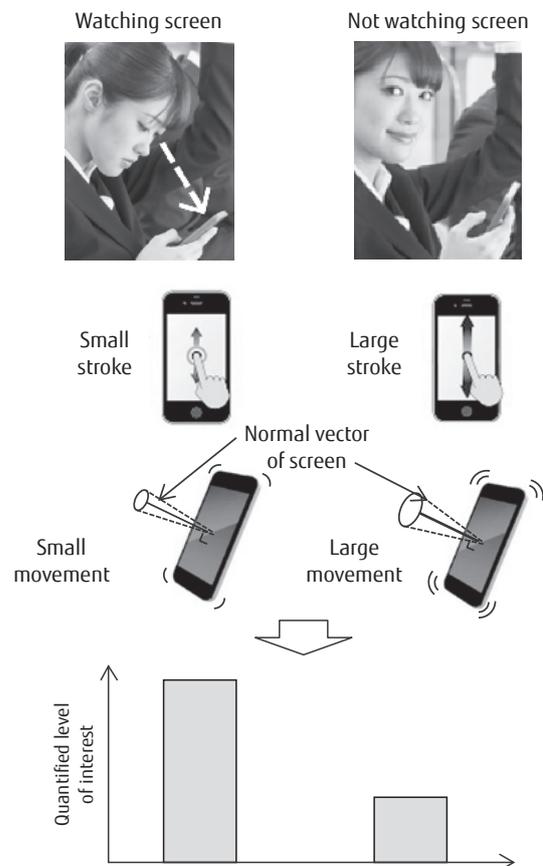


**Figure 4**  
Offering adequate feedback by analyzing a customer's psychological state.

buttons, adequate evaluation is difficult. For example, when there is no activity over a certain period, the technique cannot detect whether the customer is hesitating, reading intently, or looking away without any interest. In the case of an e-commerce site, the goal is to detect the customer's psychological state before the click that adds the product or service to the cart.

### 3.2 Developed technology

Our technology detects a customer's psychological state on the basis of the various screen scrolls made on the customer's smartphone and the movement of the phone when the customer is reading the website slowly and carefully and when the customer is not doing so. As shown in **Figure 5**, when the customer is looking at the screen closely and reading it slowly and carefully, the stroke quantity and amount of screen movement are small. When the customer is not looking at it closely, the stroke quantity and amount of device



**Figure 5**  
Principle of quantifying intensity of user's interest.

movement are large. Using this principle, we derived a model formula for quantifying the intensity of interest that is not dependent on the design of the webpage. Considering this quantified value along with the frequencies of operations on the webpage, our technology detects the customer's level of interest and hesitation. Compared with technologies based on time spent on the webpage, our Touch Emotion Analysis Technology detects less interest when the customer does not read the webpage carefully, even if the elapsed time is long.

### 3.3 Effect of technology

We conducted an experiment to evaluate our Touch Emotion Analysis Technology. Our experimental results for the 32 participants showed that our technology correctly detected 76.6% of the participants' psychological state regarding hesitation. Even if the hesitation was misdetected, the usability was not degraded because the participants mentioned in the post-experiment questionnaire that they felt that they were being supported quietly.

These detection results indicate that it is possible to connect a customer to a 'question and answer' chatbot or to an operator to provide support more effectively. Such omni-channel customer support should improve customer satisfaction. **Figure 6** shows an example of a possible application to an e-commerce site. This scenario assumes that a customer visiting an e-commerce site selects a product that he wants to buy. While he is reading a webpage on his smartphone, the system continues to send data on his actions and the movement of his phone to an analysis server where his psychological state is analyzed. If the system detects hesitation, an icon appears on the screen to prompt him to chat with a chatbot or talk with an operator. Our technology links the web channel to the communication channel, thus providing a function to ensure omni-channel support.

Our technology can detect unconscious uncontrolled feelings on the basis of minor differences in hand and finger movements when using a smartphone. It can also be applied to an e-commerce site without making the user feel unsafe, compared with conventional technologies such as taking a picture of the user. Because only the sensor in the smartphone is used for our technology, additional hardware and software are unnecessary, and it can be implemented

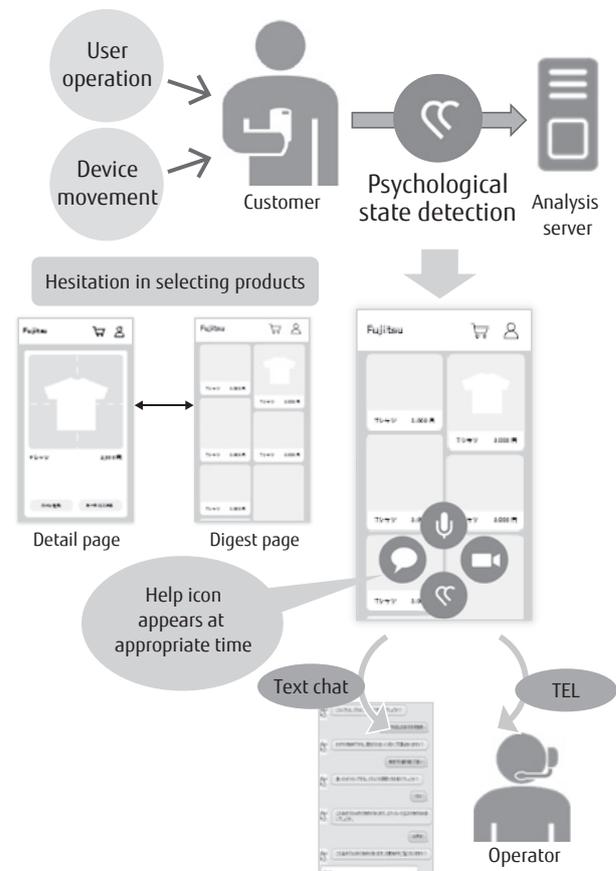
with a standard web browser. Our technology will enable the development of new services customized to a user. For example, after it detects a website customer's psychological state, it can send pertinent information tailored for him to be displayed on his smartphone.

## 4. Speech Emotion Analysis Technology

The third media processing technology that supports Affective Digital Marketing is "Speech Emotion Analysis Technology," which identifies when the customer feels satisfied or dissatisfied during conversations with reception sites such as call centers.

### 4.1 Background and problems of conventional technologies

Direct communication with customers is via reception sites such as call centers and banks. Therefore, the customer's reactions regarding products, services, companies, etc. are often obtained through conversation.



**Figure 6** Application of technology to e-commerce site.

For example, a customer's interest in and concerns about the content of offered services can be obtained from inquiries about new contracts, and a customer's dissatisfaction with and demand for service can be obtained from inquiries regarding changes to a contract. It is basic marketing policy for a company to gather customer reactions about products and services and to analyze customers' needs. Therefore, it is logical to expect a customer's psychological frame of mind, including satisfaction and dissatisfaction, to be captured in conversational speech data collected at the reception site and to be applied to a marketing strategy.

Previously, efforts were made to capture customer feelings by converting conversations with customers into text using voice recognition software.<sup>4)</sup> But not only do actual conversations not always follow standard grammar, they can also be impacted by surrounding noise. As a result, there are many technical difficulties in converting conversations into text through voice recognition, resulting in many instances where the conversion is converted incorrectly. In addition, even if people use the same words, the meaning can greatly vary depending on their emotions, so it is difficult to correctly interpret a customer's emotions using technologies that analyze speech that has been converted into text.

## 4.2 Developed technology

### Our Speech Emotion Analysis Technology

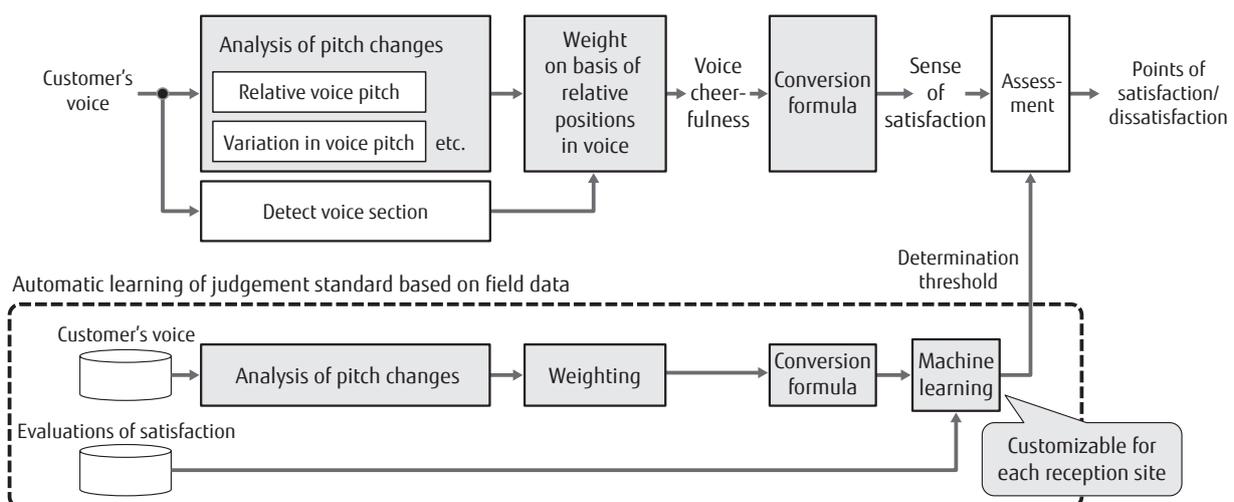
automatically determines the times in a conversation when the customer feels satisfied or dissatisfied. It does this on the basis of the features of their voice in relation to the way he or she is speaking with the service representative.<sup>5)</sup> The flow is shown in **Figure 7**. First, the level of satisfaction that the customer feels is automatically quantified on the basis of average pitch and pitch changes. This is done using judgement thresholds determined from field data and the times in the conversation when the customer expresses satisfaction or dissatisfaction. Features of this technology are as follows.

- 1) Quantifying "voice cheerfulness" from patterns of changes in voice pitch

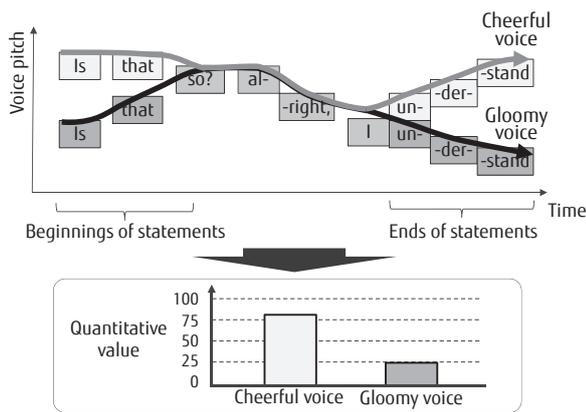
A cheerful voice is ordinarily one with a high tone or one in which the voice's tone and volume change a great deal. Moreover, Fujitsu Laboratories has determined through proprietary research that cheerful voices have unique characteristics of change at the beginnings and ends of statements. As a result, by using a method that takes into account unique changes at certain positions in voice data across multiple words, in addition to analyzing a voice's average pitch and changes, Fujitsu Laboratories has succeeded in accurately quantifying the cheerfulness of a voice (**Figure 8**).

- 2) Automatic learning of judgement standard from field data

Because there is a highly correlated relationship between perceived voice cheerfulness and degree of



**Figure 7**  
Flow of Speech Emotion Analysis Technology.



**Figure 8**  
Example of quantification of voice cheerfulness.

satisfaction, we quantify the sense of satisfaction in a conversation using voice cheerfulness quantified using a proprietary conversion formula based on survey results. By combining this with customer service evaluations and using machine learning to find a threshold point between satisfaction and dissatisfaction, we have developed technology to automatically identify times during a conversation when the customer is satisfied or dissatisfied. Along with the learning, by customizing judgement standards for each reception site, it is possible not only to extract a feeling of satisfaction or dissatisfaction that everyone understands but also to discern the subtle undertones of the psychological state that only expert service personnel can detect.

### 4.3 Effect of technology

This technology was able to determine instances of satisfaction and dissatisfaction in conversations recorded in call centers with 69.7% accuracy. As a result, conversations with service personnel can be analyzed later, and appropriate training can be offered.

Moreover, the point in the call when the customer's frame of mind changes from satisfied to dissatisfied can be efficiently analyzed, for example by using this technology as applied to past inquiries. Information on a product or service of interest to the customer can be grasped, and the customer's level of satisfaction with their treatment can be understood. As a result, appropriate customer service for individual customers can be expected. In addition, customer demand for a product and improvements in overall customer service can be anticipated by analyzing areas where large numbers of

customers experienced satisfaction and dissatisfaction.

## 5. Conclusion

This paper set out the technical features of three media processing technologies that support Affective Digital Marketing: Advertising Copy Creation Assistive Technology, Touch Emotion Analysis Technology, and Speech Emotion Analysis Technology. It also presented example application scenarios in the digital marketing field.

These technologies can achieve Affective Digital Marketing that creates an unprecedented customer experience by capturing affective information such as customer interest and satisfaction that were not previously available and by appealing to individual customers during the purchase phase in a timely manner.

By analyzing customer psychology more accurately using our technologies and applying the developed technologies to the digital marketing product or application programming interface of Fujitsu's AI Technology, "Human Centric AI Zinrai,"<sup>6)</sup> we can use them for a solution service in the digital marketing field. Also, we are aiming to commercialize them for use in a variety of situations where affective information on users is required, such as retail banking, retail sales, healthcare, and training.

## References

- 1) J. Baba et al.: Automatic Generation of Title and Description Texts for Sponsored Search Ads, The 29th Annual Conference of the JSAI, pp. 1–4 (2015) (in Japanese).
- 2) FUJITSU JOURNAL  
<http://journal.jp.fujitsu.com/en/>
- 3) Best of the Best Benchmark, Adobe Digital Index (2015).
- 4) T. Kawahara: Voice recognition technology, The Journal of the Institute of Electronics, Information and Communication Engineers, Vol. 98, No. 8, pp. 710–717 (2015).
- 5) Fujitsu Laboratories: Fujitsu Technology Uses Conversational Speech to Identify Customer Satisfaction (2016).  
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/1017-01.html>
- 6) Fujitsu: Fujitsu Offers Deep Learning Platform with World-Class Speed, AI Services that Support Industries and Operations (2016).  
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/1129-01.html>



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