July 03, 2019

Transforming Copied Text Based on Paste Destination

Matt Sharifi

Transforming Copied Text based on Paste Destination

Abstract:

This publication describes systems and techniques directed to transforming copied text based on a paste destination. A user selects, via user input at a computing device, a text string that is output by a first application. The computing device analyzes the text string using natural language processing algorithms to identify associations between the text string and entities included in a knowledge base. In one example, an entity annotator analyzes the text string to determine a meaning and context of the text string (*e.g.*, keywords, data types, conditions, etc.). The computing device generates, based on the meaning and context, a structured version of the text string by mapping a unique set of identifiers (IDs) that correspond to entities included in the knowledge base to the text string. The computing device then stores the structured version of the text string at intermediary storage. In response to receiving a paste command, the computing device identifies a destination context associated with the paste command and uses the destination context to identify augmented paste content from the knowledge base. In turn, the computing device pastes the augmented paste content to the destination.

Keywords:

text, application context, paste option, structured text, attribute, knowledge base, annotator, machine-learning, clipboard, rank, summarized output, name table, analyze, entity

Background:

Users frequently copy text from source content and paste the text to a destination field, such as by copying text from a first application and pasting the copied text into a second

application. To illustrate, consider a scenario in which a user receives an address in the body of an email, and copies the address from the email into an input field of a mapping application. In such a scenario, the copy-paste process replicates the entirety of the selected content from the email to the mapping application, thus allowing a user to move content between the applications. Oftentimes, however, the fixed nature of replicating the selected content in its entirety at the destination fails to accommodate differences between the source and the destination.

Description:

This publication describes systems and techniques directed to transforming copied text based on a paste destination. A user selects, via user input at a computing device, a text string that is output by a first application. The computing device analyzes the text string using natural language processing algorithms to identify associations between the text string and entities included in a knowledge base. In one example, an entity annotator analyzes the text string to determine a meaning and context of the text string. The computing device generates, based on the meaning and context, a structured version of the text string by mapping a unique set of identifiers (IDs) that correspond to entities included in the knowledge base to the text string. The computing device then stores the structured version of the text string at intermediary storage. In response to receiving a paste command, the computing device identifies a destination context associated with the paste command and uses the destination context to identify augmented content from the knowledge base. In turn, the computing device pastes the augmented content to the destination.

Fig. 1, below, illustrates an example computing device and elements of the computing device that support transforming copied text based on a paste destination. While Fig. 1 illustrates a smartphone, other types of computing devices can implement features of transforming copied

text based on a paste destination (*e.g.*, a tablet, a laptop computer, a wearable device, a desktop personal computer, etc.).

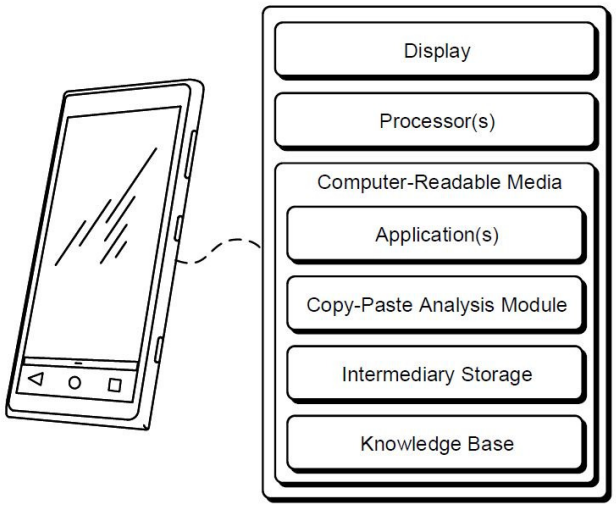

Fig. 1

The computing device includes a display that can visibly render output and/or receive input, such as a Light Emitting Diode (LED) display or a Liquid Crystal Display (LCD) with touchscreen capabilities. The computing device also includes a processor that performs basic functionality (*e.g.*, arithmetic, logical, fetching, decoding) to implement features of transforming copied text based on a paste destination. The processor may be a single-core processor, or a multiple-core processor composed of a variety of materials.

The computing device also includes a computer-readable medium (CRM) storing one or more application(s), a copy-paste analysis module, intermediary storage, and a knowledge base. The CRM may include any suitable memory or storage device such as random-access memory (RAM), static RAM (SRAM), dynamic RAM (DRAM), non-volatile RAM (NVRAM), read-only memory (ROM), or Flash memory. While the application(s), copy-paste analysis module, intermediary storage, and the knowledge base are illustrated as residing in the CRM, other implementations can include any combination of firmware, hardware, and/or software.

The application(s) generally represent collections of software instructions that, responsive to execution by the processor, output selectable content, such as text strings that are selectable by a copy instruction implemented via the copy-paste analysis module. Alternately or additionally, the application(s) receive content as input to a control field through a paste instruction implemented by the copy-paste analysis module.

The copy-paste analysis module represents functionality that selects content output by an application and stores the selected content at intermediary storage, such as through a copy operation. In selecting and storing the content, the copy-paste analysis module evaluates the selected content to identify whether any entities included in the knowledge base correspond to the selected content. As one example, the copy-paste analysis module can include natural language processing algorithms that analyze a text string to identify meaning, context, characteristics, and/or traits associated with the text string. In turn, the copy-paste analysis module correlates the meaning, context, characteristics, and/or traits to the knowledge base and generates a structured version of the text string. For instance, the structured version of the text string can include a unique set of ID's that map to entities included in the knowledge base that relate to the text string. In turn, the copy-paste analysis module stores the structured version of the text string to the intermediary storage.

During a paste operation, the copy-paste analysis module can analyze a context of a destination and use the context to determine what content to use as input to the destination. For instance, machine-learning algorithms implemented by the copy-paste analysis module can rank the identified content features (*e.g.*, meaning, context, characteristics, and/or traits), where the machine-learning algorithms generally represent machine-learned model(s) with learning-based framework(s) to identify relationships between the entities included in the knowledge base, the

features included in the copied content, and/or the destination context. Using machine-learning algorithms, the copy-paste analysis module can augment content input to the destination with information from the knowledge base, such as by extracting information from entities that have a higher rank and/or correlation to the destination relative to other entities.

The intermediary storage generally represents an intermediary storage location for copied content and/or a structured version of the copied content generated by the copy-paste analysis module. Further, the intermediary storage can store any combination of content associated with the copy-paste analysis module, such as mappings between the copied content and entities included in the knowledge base, the originally selected content, etc.

The knowledge base stores a collection of information accessible to the computing device, where the information is stored in a structured manner. As one example, the knowledge base employs a data model that identifies data entities within the information, attributes of the data entities, and/or relationships between the data entities. This can include knowledge about a particular user, such as user preferences, user location, user profiles, etc. At times, the user may have control over what information is collected, how that information is used, and what information is provided to the user from that knowledge. The copy-paste analysis module correlates the identified features to the various entities within the knowledge base to identify which entities relate to the copied content. While Fig. 1 illustrates the knowledge base as residing on CRM local to the computing device, the knowledge base can alternately reside external to the computing device, such as via a cloud-based service.

Fig. 2 illustrates an example technique associated with transforming copied text based on a paste destination. The technique is performed using elements of a computing device that is

illustrated in the form of a tablet, but any suitable computing device can be utilized. In Fig. 2, the computing device includes a copy-paste analysis module and a knowledge base.

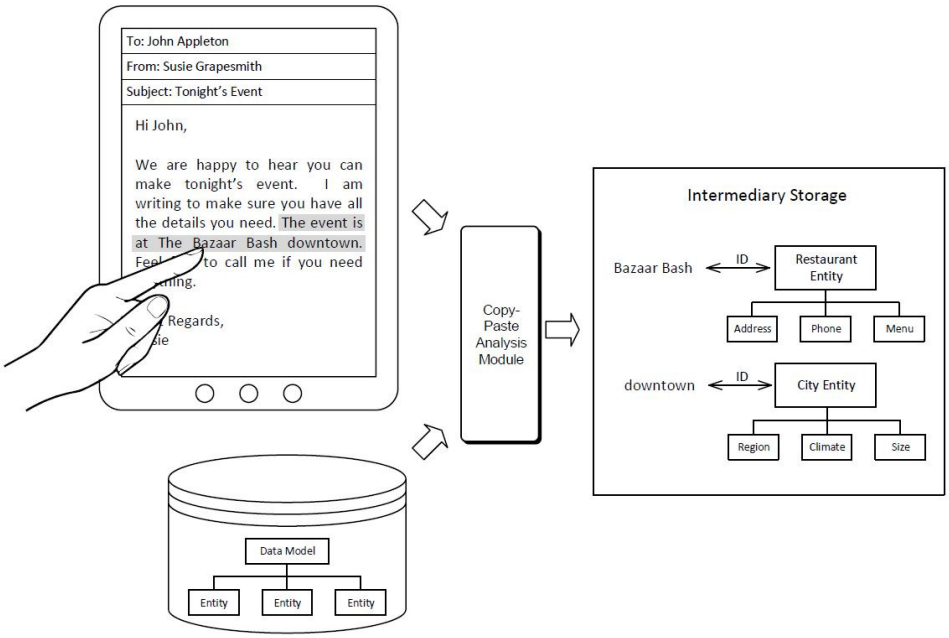

Fig. 2

In the example technique of Fig. 2, a user selects a text string from an email client as content to copy. In turn, the copy-paste analysis module receives the text string as input and analyzes the content using natural language processing algorithm(s) to identify various features. In this example, an annotation algorithm implemented by the copy-paste analysis module identifies "The Bazaar Bash" and "downtown" as keywords. The copy-paste analysis module then correlates the keywords to entities included in the knowledge base through various machine-learning algorithms, such as through any combination of data mining, collaborative filtering, content-based filtering, etc.

In Fig. 2, the copy-paste analysis module correlates the keywords "The Bazaar Bash" to a restaurant entity, and "downtown" to a city entity, where each entity has respective attributes. These entities can be generic entities that provide attributes and details applicable to multiple

different instances, or specific entities that provide attributes and details applicable to a specific instance. In other words, the restaurant entity can provide details that are applicable to multiple different restaurants or can be particular to "The Bazaar Bash" where the entity details pertain uniquely to "The Bazaar Bash" restaurant. In response to identifying related entities within the knowledge base, the copy-paste analysis module forms a structured version of the text string and stores the structured version in intermediary storage. In Fig. 2, the structured version of the text string includes a set of IDs that map the copied content (*e.g.*, keywords "The Bazaar Bash" and "downtown") to entities within the knowledge base. The copy-paste analysis module can alternately or additionally copy the selected (unstructured) content to the intermediary storage, either with the structured version or without the structured content if no related entities are identified.

Fig. 3, below, illustrates a continuation of the example described with respect to Fig. 2.

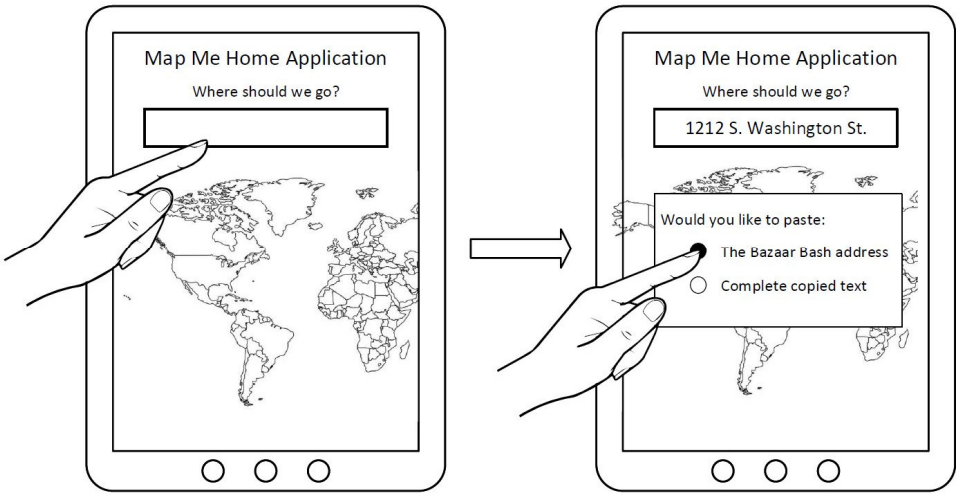

Fig. 3

On the left side of Fig. 3, the computing device renders a user interface of a mapping application that includes a data field for entering address information. As the user interacts with

the data field, the computing device interprets the input as a command to paste content from the intermediary storage.

Generally, the copy-paste analysis module analyzes a paste destination to identify a current context, such as data field attributes, application type, application function, user input type, and so forth. For instance, the copy-paste analysis module accesses metadata associated with the destination application to identify that the destination corresponds to a mapping application and that the data field being interacted with corresponds to an address field. In turn, the copy-paste analysis module ranks the structured version of the text string using machine-learning algorithms based on the destination context, such as supervised machine-learning algorithms, semi-supervised machine-learning algorithms, content-based filtering algorithms, etc. With respect to Fig. 3, the machine-learning algorithm determines that the restaurant entity includes an address attribute, and that the address attribute has a higher relevance to the destination relative to the menu attribute. Accordingly, the machine-learning algorithm ranks the address attribute of the restaurant entity higher than the menu attribute. Based upon the ranked attributes, the copy-paste analysis module determines to paste address content to the destination. This can include the copy-paste analysis module determining to augment the paste content with information from the knowledge base. To illustrate, instead of pasting “The event is at the Bazaar Bash downtown” as selected and copied by the user, the copy-paste analysis module can access the address attribute of the restaurant entity in the knowledge base and transform the paste content by augmenting the paste content with address information. In some scenarios, the copy-paste analysis module automatically inputs the transformed and/or augmented content to the destination. However, the copy-paste analysis module can alternately provide multiple different paste options to the user.

Moving to the right side of Fig. 3, the computing device renders, by way of the copy-paste analysis module, selectable paste options to the user. The first option corresponds to pasting the transformed and/or augmented paste content identified by the copy-paste analysis module (*e.g.*, the address of The Bazaar Bash). The second option allows the user to input the originally selected and copied content into the destination data field. While two options are illustrated in Fig. 3, it is to be appreciated that any suitable number of options can be provided to the user. In some cases, the copy-paste analysis module determines and provides a threshold number of options based upon the ranked attributes and/or entities.

Fig. 4, below, illustrates additional techniques of transforming copied text based on a paste destination.

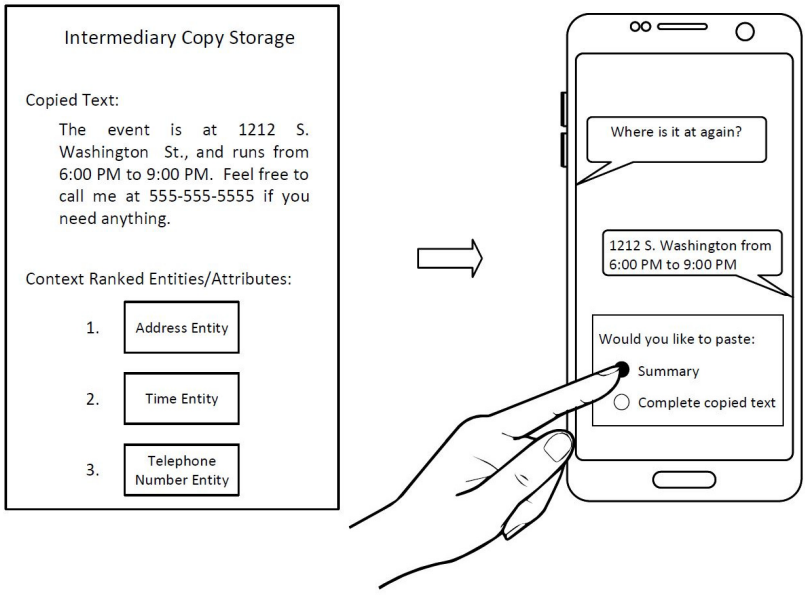

Fig. 4

In this illustration, the computing device is illustrated as a smartphone, where the user has selected a text string that a copy-paste analysis module has analyzed, transformed, and/or mapped

to entities within a knowledge base. On the left side of Fig. 4, the intermediary storage includes the original copied text as well as a structured version of the copied text that maps features of the copied text to entities within the knowledge base. Here, the copy-paste analysis module has ranked the mappings based upon a destination context. Moving to the right side of Fig. 4, the destination of the paste command corresponds to input to a Short Message Service (SMS) field that has a fixed length.

Here, the length of the originally copied text exceeds the size of the destination input field, where the number of characters within the copied text exceeds the allowable number of characters for the destination input field. In scenarios in which the length of the originally copied content exceeds a length of a destination, the copy-paste analysis module generates a summarized version of the original content. In Fig. 4, the copy-paste analysis module determines that the destination input field corresponds to a fixed length SMS message and that the copied text exceeds the input length of the destination input field. In some scenarios, the copy-paste analysis module also determines that the destination context corresponds to replying to a question. Based upon the incompatible lengths between the copied text and destination input field, the copy-paste analysis module determines to generate a summarized version of the copied text. Further, through an analysis of the ranked features and/or destination context, the copy-paste analysis module determines that the address entity has a higher ranking relative to other attributes and generates the summary based on the higher ranked attribute. Thus, the copy-paste analysis module can identify when copied content has an incompatible length with the destination and generate a summarized version of the copied content, where the content of the summarized version is based upon ranked features. In some scenarios, the copy-paste analysis module provides the user with a summary paste option as illustrated on the right side of Fig. 4. The copy-paste analysis module can

alternately insert the summarized version of the copied content into the destination input field automatically.

Further to the descriptions above, a user may be provided with controls allowing the user to make an election as to both if and when systems, programs or features described herein may enable collection of user information (*e.g.*, information about a user's social network, social actions or activities, profession, a user's preferences, or a user's current location), and if the user is sent content or communications from a server. In addition, certain data may be treated in one or more ways before it is stored or used, so that personally identifiable information is removed. For example, a user's identity may be treated so that no personally identifiable information can be determined for the user, or a user's geographic location may be generalized where location information is obtained (such as to a city, ZIP code, or state level), so that a particular location of a user cannot be determined. Thus, the user may have control over what information is collected about the user, how that information is used, and what information is provided to the user, such as information included in the knowledge base.

In conclusion, transforming copied text based on a paste destination provides context-based support to the user by identifying information within a knowledge base that relates to the paste destination and providing automatic access to the relevant content without additional user input.

References:

[1] Patrick Michael Commarford and James Lee Lentz. Automated Clipboard Software. US Pub. No. 2011/0125970, filed November 25, 2009 and published May 26, 2011.

[2] Yuan Cheng, Yue Ma, Min Qu, and Hai F. Zhang. Data Object Copy/Paste Transfer Method and Apparatus. US Pub. 2009/0157741, filed December 11, 2008 and published June 18, 2009.