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Systems and Methods for Contextually Relevant Search Results

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SYSTEMS AND METHODS FOR CONTEXTUALLY RELEVANT SEARCH RESULTS

Introduction

Traditionally, image search systems focus on identifying object(s) and generating generalized search results pertaining to the object(s). As such, a traditional image search system may be able to identify an object in an image, but may not be able to determine individual attributes of the object such as that the object is damaged or misshapen. There remains a need for a search system that can return contextual information associated with an identified object.

Summary

Computer-implemented systems and methods for generating contextually relevant search results for identified objects in images are provided. An enhanced user search experience with more accurate search results pertaining to image searches and the like is provided. By way of example, an image search may include a query image comprising an object (e.g., good). The system may identify the object in the image and also identify contextual information associated with the object. For example, the system may analyze the image and determine that the object is damaged, malformed, or misshapen in some manner. In response, the system may provide contextually-relevant search results which may more accurately represent a user's intent in performing the image search. As another example, the system may identify that an object in an image reflecting a sporting event is a cup. In response, the system may generate search results for nearby concession stands rather than generalized search results for cups.

Consider in more detail an example of an image depicting a damaged or object. The user may wish to submit an image query of the object and receive results related to repair or replacement of the object. The user may be unsure as to what the part is, how to fix the part, who can fix the part, or other information regarding the damaged state of the object. The user may provide an image of the object in its damaged state to the image search system. The image

search system may identify the object and contextual information related to the object in the image. For example, the system may determine that the object is damaged (e.g., in response to a lack of direct correspondence with a reference image). In response, the system may determine search results relevant to the damaged state of the object as well as the object itself. For example, in response to a picture of a broken bicycle wheel, the system may determine that the user intent in the search query is to determine how or who can fix a broken bicycle wheel. The system may return search results including a listing of replacement parts for the broken portion of the bicycle wheel, videos or images depicting how to fix the broken bicycle wheel, or locations of bicycle shops which may assist the user in fixing the broken bicycle wheel.

Computer-implemented systems and methods for providing search results relating to damaged, malformed, or misshapen objects within an image search with the disclosed technology may provide for more accurate search results corresponding to a user's intent, and an easier searching experience for the user. In one example, a user may provide an image of a damaged object to an image search system. The image search system may incorporate one or more machine learned models to determine objects within images. At least one of the one or more machine learned models may generate a similarity score or confidence probability associated with its determined output. When the image search system is provided the image of a damaged object, the image search system may rely on the similarity score or confidence probability to determine that the object in the image is damaged. For example, the similarity score or confidence probability may be noticeably lower than a score for a perfect object, but above a threshold to signify that the damaged object is still the object and not something else. In some instances, the one or more machine learned models may be trained using training data pertaining to damaged or misshapen objects. In this manner, the one or machine learned models

may comprise additional categories pertaining to damaged or misshapen goods, and they may be used to generate more accurate outputs. In some instances, the one or more machine learned models may be trained using training data pertaining to particular objects as well as damaged or misshapen objects. In this manner, the similarity scores or confidence probabilities may remain higher for an object, regardless of whether it is broken or not, without a dedicated category to the damaged or misshapen object. In one embodiment, the image search system may provide repair or replacement part search results even if there is no indication of a damaged or misshapen object in an image. In determining the object in the image, the image search system may know the age and history of the object and provide repair or replacement part search results based on the age and history of the object alone.

The image search system may identify an object as being damaged or misshapen in a given image and generate contextually relevant results pertaining to the damaged state of the object, as opposed to results pertaining to the object itself. Based on the output of one or more machine learned models within the image search system, the image search system may generate contextually relevant search results pertaining to remedies or information on the damaged or misshapen state of the object. For example, the search results may comprise replacement components for the damaged or misshapen object, as well as alternatives to replace the damaged or misshapen object along with information about the object. In another example, the search results may comprise links to stores that provide goods or services to repair or replace the damaged object. The search results may also comprise video or article results pertaining to how to fix the damaged object. In some instances, the search results may comprise links to third party services or providers for handling the damaged or misshapen object. For example, a user may have an old device of which they have no repair or component knowledge. The user can take an

image of the old device and provide it to an image search system. The image search system can identify the object in the image and that the object is damaged. The image search system may generate results comprising one or more links to third-party services that specialize in repairing the old device. The user may then interact with the third-party services via the one or more links to purchase necessary replacement parts or schedule a repair appointment without clicking through any further links or search results. In some examples, the image search system may verify that the third-party services are certified or specialized.

According to some aspects, a query image comprising a damaged or misshapen object may be generated on a user computing device. The query image may be sent to a remote computing system to perform image analysis and object determination. The remote computing system may include one or more machine learned models to which the query image is provided as input. Based on the output of the machine learned model(s), the remote computing system may determine an object in the query image and that the object is damaged or misshapen. The remote computing system may generate contextually relevant search results for the query image pertaining to both the query image and the damaged or misshapen state of the object. The search results are sent from the remote computing system to the user computing device to be displayed to the user. In some embodiments, the query image is generated on the user computing device and one or more machine learned models stored within the user computing device are utilized to detect objects and object states such as, for example, a damaged bicycle wheel or an intact bicycle wheel. Systems and methods described herein to identify objects and determine object states related to query images and generate contextually relevant search results based on determined objects and object states are for descriptive purposes only. Any combination or order of the methods described herein can be executed on a user computing device, remote computing

device, or similar. For example, all steps of generating search results for a query image of a damaged object may be performed on a remote computing system or parts of the process can be performed on a user computing device and others on a remote computing system as previously described.

Detailed Description

FIG. 1 depicts an example computing system 100 in which systems and methods in accordance with the present disclosure can be executed. The computing system comprises a user computing device 102 containing one or more processors 112, memory 114 which may contain data 116 and instructions 118 configured to carry out the methods disclosed herein, and a user input component 122. The user input component can be, for example, a touch display, camera, or physical buttons within the user computing device 102. The computing system 100 further comprises a network 180 and a server computing system 130. The server computing system 130 comprises one or more processors 132, and memory 134 which may contain data 136 and instructions 138 configured to carry out the methods disclosed herein. For example, a user may generate a query image via the user input component 122 of the user computing device 102. The query image can be sent over the network 180 to the server computing system 130. The server computing system 130 may input the query image to one or more machine learned models and generate an output. The output may comprise an object identification and a confidence score pertaining to the object identification. The server computing system 130 may use the object identification and the confidence score to generate contextually relevant search results. The server computing system 130 may send the search results via network 180 to the user computing device 102 which may display the search results to the user. It should be appreciated that any combination or order of systems and methods disclosed herein can be performed by the user

computing device, server computing system, or similar. For example, all processes can be performed by the user computing device 102 or the server computing system 130.

FIG. 2 depicts an example operation 200 of an image search system (not pictured) according to aspects of the present disclosure. A first image 202 depicts an object 204, which may be in an ideal state without any damage, cropped or missing components and is easily viewable. The first image 202 is input to one or more machine learned models 206 which generates an output 208. The output 208 may comprise an object identification 210 and a confidence score 212 for the output 208. The image search system may use the output 208 to generate contextually relevant search results based on the object identification 210 and the confidence score 212. In one embodiment, the image search system may use the confidence score 212 to determine whether or not an object, such as object 204 in the first image 202, is damaged or not. If the confidence score 212 is above a given threshold, the image search system can determine that the object is not damaged, for example.

A second image 214 depicts an object 216 in a damaged state, for example, having one or more portions that are damaged, missing, or poorly distinguishable. The second image 214 is input to one or more machine learned models 218. The one or more machine learned models 218 may generate a second output 220 based on the second image 214. The second output 220 may comprise a second object identification 222 and a second confidence score 224. The confidence score may pertain to the one or more machine learned models' confidence in the second object identification 222. The image search system may take the second output 220 and generate contextually relevant search results pertaining to both the object identification 222 and the confidence score 224. If the confidence score 224 is below a given threshold, the image search

system may determine that an object has broken or missing components. Machine learned model(s) 206 and 218 may be the same model(s) in some examples.

Referring now to FIG. 3, an example process 300 according to aspects of the present disclosure is provided. At 302, process 300 may include receiving an image from a user. For example, an image search system may receive an image depicting a broken or damaged object. At 304, the image search system may input the image to one or more machine learned models. The one or more machine learned models may generate an output comprising an object identification and a confidence score. The confidence score may comprise a score or percentage that pertains to a confidence value generated by the model(s) reflecting a confidence of the object identification. At 306, the image search system may analyze the object identification and confidence score to determine whether or not the object identified within the image is damaged or includes missing components. For example, if the confidence score is below a first given threshold, but above a second given threshold, the image search system may determine that the object is damaged or missing components. At 308, the process further includes generating search results based on the object and object state within the image. The search results may include, but are not limited to, third part services for repairing or replacing components of the object, replacement components for the object, how-to articles or videos, or similar results pertaining to the object and the object state determined by the one or more machine learned models and the image search system. At 310, the image search system may provide search results to the user determined by the image search system.

Figures

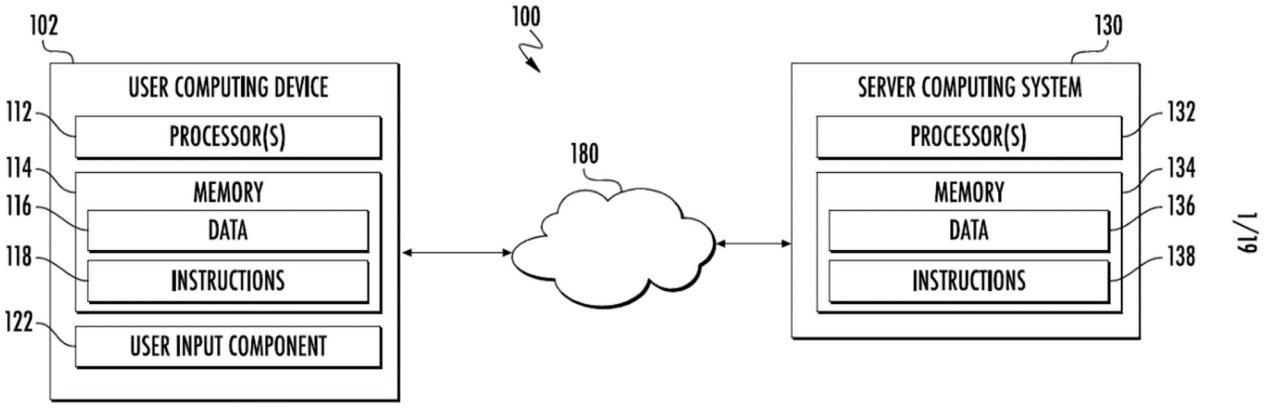

FIG. 1

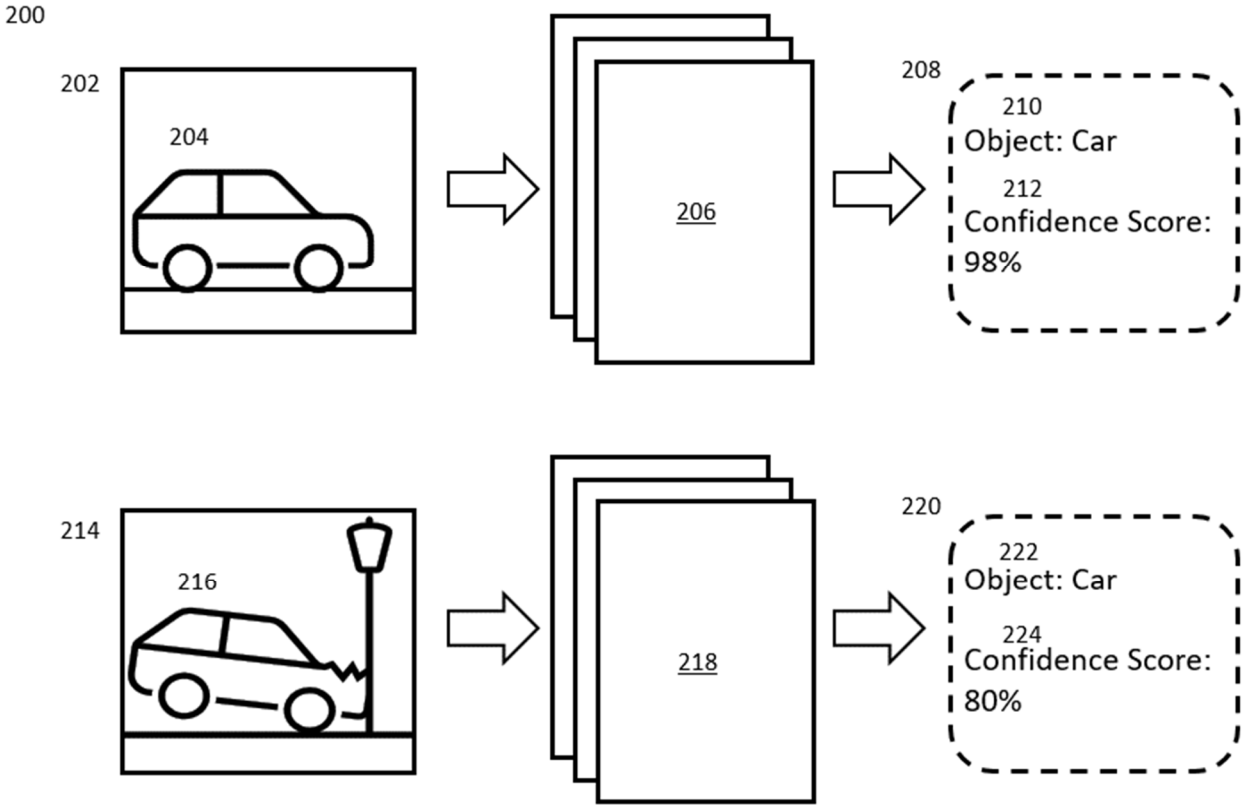

FIG. 2

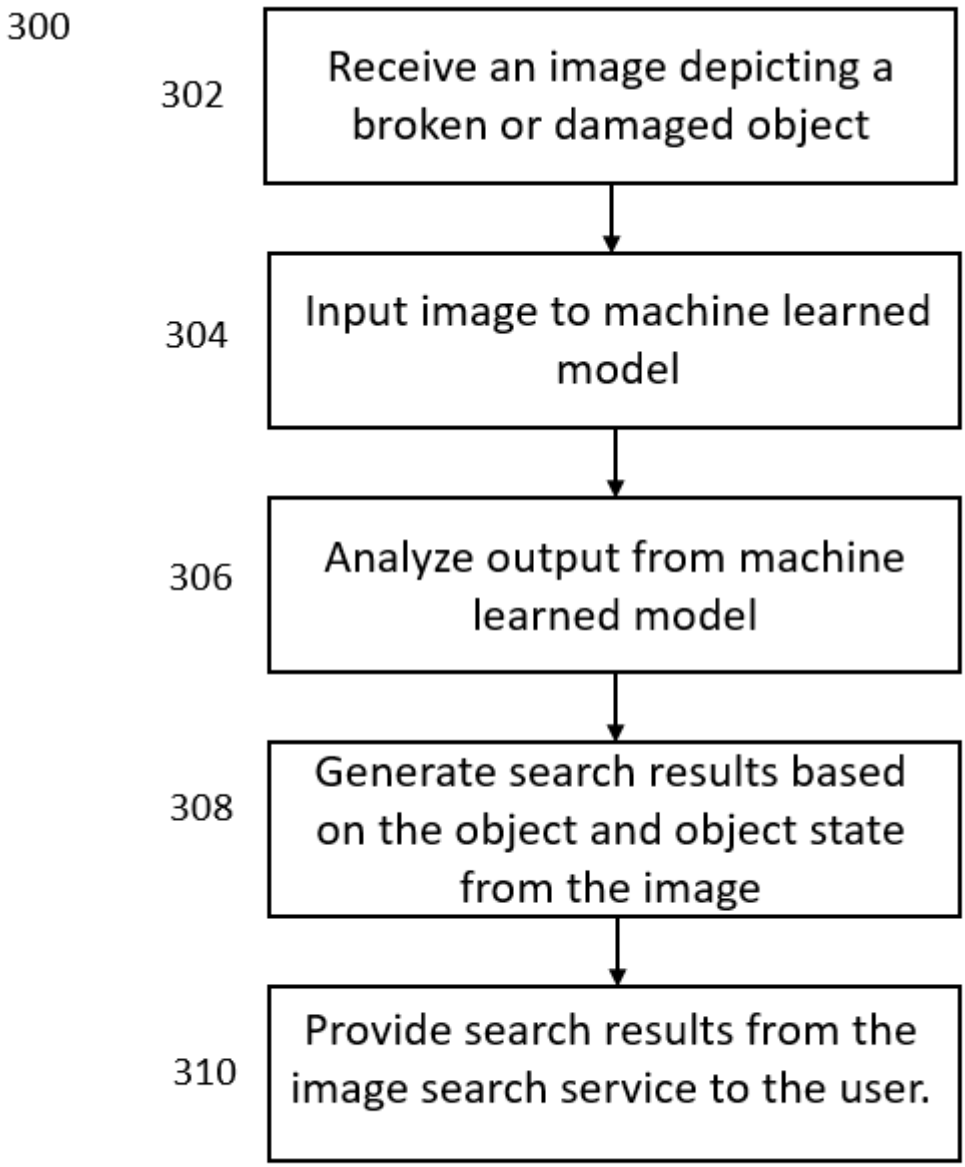
300
302
Receive an image depicting a broken or damaged object
304
Input image to machine learned model
306
Analyze output from machine learned model
308
Generate search results based on the object and object state from the image
310
Provide search results from the image search service to the user.

FIG. 3

Abstract

The present disclosure describes computer-implemented systems and methods for generating image search results pertaining to both the objects within an image as well as state of the objects. A user may provide an image to an image search system. The image search system may determine an imperfect object within the image and generate search results tailored toward the object being damaged or malformed. Search results may include, but are not limited to, replacement parts, third party repair services, how-to repair videos, or similar.