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(54) Title: TECHNIQUES FOR VISUALIZING AND EXPLORING LARGE-SCALE GENERATIVE DESIGN DATASETS

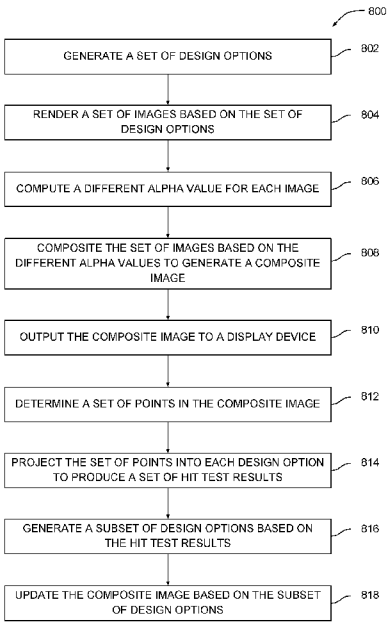

FIG. 8

(57) Abstract: A design application is configured to visualize and explore large-scale generative design datasets. The design explorer includes a graphical user interface (GUI) engine that generates a design explorer, a composite explorer, and a tradeoff explorer. The design explorer displays a visualization of a multitude of design options included in a design space. The design explorer allows a user to filter the design space based on input parameters that influence a generative design process as well as various design characteristics associated with the different design options. The composite explorer displays a fully interactive composite of multiple different design options. The composite explorer exposes various tools that allow the user to filter the design space via interactions with the composite. The tradeoff explorer displays a tradeoff space based on different rankings of design options. The different rankings potentially correspond to competing design characteristics specified by different designers.

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[Continued on next page]

TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2019/028625

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F17/50
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, COMPENDEX, INSPEC, IBM-TDB, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JUSTIN MATEJKA ET AL: "Dream Lens: Exploration and Visualization of Large-Scale Generative Design Datasets", CHI 2018, APRIL 21-26, 2018, MONTRÉAL, QC, CANADA, 21 April 2018 (2018-04-21), pages 1-12, XP055607788, the whole document page 4, column 2, paragraph 2 - paragraph 4 page 4, column 2, last paragraph - page 5, column 2, paragraph 2 figures 6, 9 page 6, column 2, paragraph 4 - page 7, column 1, paragraph 4 figures 15, 16 page 7, column 2, paragraph 5 - page 8, column 2, paragraph 3 ----- -/--	1-20

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 October 2019	07/11/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Wellisch, J

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Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Justin Matejka ET AL: "Dream Lens: Exploration and Visualization of Large-Scale Generative Design Datasets", youtube video, 20 April 2018 (2018-04-20), pages 1-4, XP055607800, Retrieved from the Internet: URL:https://www.youtube.com/watch?v=gjsEhS8etlk [retrieved on 2019-07-22] the whole document page 2, lower figure page 3, lower figure page 4, both figures	1-20
A	YUKI KOYAMA ET AL: "Crowd-powered parameter analysis for visual design exploration", USER INTERFACE SOFTWARE AND TECHNOLOGY, ACM, 2 PENN PLAZA, SUITE 701 NEW YORK NY 10121-0701 USA, 5 October 2014 (2014-10-05), pages 65-74, XP058058543, DOI: 10.1145/2642918.2647386 ISBN: 978-1-4503-3069-5 the whole document page 66, column 2, paragraph 2-5 page 69, column 2	1-20
A	LOUTFOUZ ZAMAN ET AL: "GEM-NI: A System For Creating and Managing Alternatives In Generative Design", CHI 2015, CROSSINGS, SEOUL, KOREA, 18 May 2015 (2015-05-18), pages 1201-1210, XP055607802, the whole document page 1205, column 2, last paragraph - page 1207, column 1, paragraph 2 figure 5	1-41
X	WO 02/103581 A2 (ANALOG DESIGN AUTOMATION INC [CA]; MCCONAGHY TRENT LORNE [CA]) 27 December 2002 (2002-12-27) the whole document page 3, paragraph 2 page 7, paragraph 3 - paragraph 5 page 8, paragraph 2 - page 9, paragraph 6 figures 17-22	21-41

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FERRINGER M P: "General framework for the reconfiguration of satellite constellations", INTERNET CITATION, 19 November 2008 (2008-11-19), pages 1-40, XP007914306, Retrieved from the Internet: URL:http://etda.libraries.psu.edu/theses/approved/WorldWideIndex/ETD-3537/index.html the whole document page 2, subpage 3, last paragraph - page 3, subpage 5, paragraph 1 "Chapter 3 Methodology" page 4, subpage 58, paragraph 1 page 5, subpage 64, paragraph 1 - page 7, subpage 71, paragraph 1 figures 3-3 to 3-7 -----	21-41
X	GODFREY P BRIGHTEN ET AL: "Stabilizing Route Selection in BGP", IEEE / ACM TRANSACTIONS ON NETWORKING, IEEE / ACM, NEW YORK, NY, US, vol. 23, no. 1, 1 February 2015 (2015-02-01), pages 282-299, XP011573484, ISSN: 1063-6692, DOI: 10.1109/TNET.2014.2299795 [retrieved on 2015-02-12] the whole document page 284, column 1, paragraph 2 - page 285, column 2, paragraph 1 page 286, column 1, paragraph 5 - page 287, column 1, paragraph 3 -----	21-41

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2019/028625

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 02103581 A2	27-12-2002	CA 2450746 A1	27-12-2002
		CN 1527980 A	08-09-2004
		EP 1402424 A2	31-03-2004
		JP 2004530991 A	07-10-2004
		US 2004153294 A1	05-08-2004
		WO 02103581 A2	27-12-2002

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2019/028625

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-20

   This set of claims relates to generating sets of design options and corresponding images.

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2. claims: 21-41

   This claim relates to generating and ranking tradeoff spaces reflecting tradeoffs between decisions.
