

**PATENT COOPERATION TREATY**

**PCT**

**INTERNATIONAL SEARCH REPORT**

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 0059-714WO1	<b>FOR FURTHER ACTION</b> see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US2020/030723	International filing date ( <i>day/month/year</i> ) 30 April 2020 (30-04-2020)	(Earliest) Priority Date ( <i>day/month/year</i> ) 30 April 2019 (30-04-2019)
Applicant  GOOGLE LLC		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 6 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

**1. Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of:

- the international application in the language in which it was filed
- a translation of the international application into \_\_\_\_\_, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b.  This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

c.  With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2.  **Certain claims were found unsearchable** (See Box No. II)

3.  **Unity of invention is lacking** (see Box No III)

4. With regard to the **title**,

- the text is approved as submitted by the applicant
- the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- the text is approved as submitted by the applicant
- the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority

6. With regard to the **drawings**,

a. the figure of the **drawings** to be published with the abstract is Figure No. 1A

- as suggested by the applicant
- as selected by this Authority, because the applicant failed to suggest a figure
- as selected by this Authority, because this figure better characterizes the invention

b.  none of the figures is to be published with the abstract

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2020/030723

## 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.:

1-6, 8, 9, 11-17, 19, 20

### 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.

**INTERNATIONAL SEARCH REPORT**

International application No  
PCT/US2020/030723

**A. CLASSIFICATION OF SUBJECT MATTER**  
 INV. G06T19/00  
 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)  
 G06T

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, EMBASE, INSPEC, 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	RICARDO MARTIN-BRUALLA ET AL: "LookinGood : Enhancing Performance Capture with Real-time Neural Re-Rendering", 20181204; 1077952576 - 1077952576, vol. 37, no. 6, 255, 4 December 2018 (2018-12-04), pages 1-14, XP058422640, ACM Transactions on Graphics DOI: 10.1145/3272127.3275099 ISBN: 978-1-4503-6008-1	1-4,6,8, 9,11-13, 15-17, 19,20
Y	abstract section 2 "related work", sub-section "learning based methods", paragraphs 1 to 4, page 3 section 3.1 "learning to enhance reconstructions", paragraphs 1 and 3, page 4 section 3.2 "image enhancement", paragraphs 1 to 5, page 4 -/--	5,14

Further documents are listed in the continuation of Box C.  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	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search  23 June 2020	Date of mailing of the international search report  08/09/2020
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Gauthier, J
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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.
Y	<p>sub-section "stereo loss", page 5                      section 4 "evaluation", paragraphs 1 and 2, page 7 - single camera dataset                      section 4.1 "volumetric capture", paragraphs 1 and 2                      sub-section "full body capture (multi-view)", paragraph 3, page 8 - viewpoint changes                      section 4.2 "qualitative results", sub-section "upper body results (single view)", page 8                      section 4.2 "qualitative results", sub-section "viewpoint robustness", page 8                      section 4.3 "ablation study", sub-section "segmentation mask", page 9                      section 5 "real-time free viewpoint neural re-rendering", page 9                      section 6 "discussion, limitations and future work", last paragraph, page 12                      figures 1,3,4,5,7,8,12,17                      -----                      BALAKRISHNAN GUHA ET AL: "Synthesizing Images of Humans in Unseen Poses", 2018 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION, IEEE, 18 June 2018 (2018-06-18), pages 8340-8348, XP033473757, DOI: 10.1109/CVPR.2018.00870                      section 1 "introduction", paragraphs 1 to 3, page 8340                      section 3 "method", paragraphs 1 to 3, pages 8341 to 8342                      section 3.1 "pose representation"                      section 3.2 "source image segmentation", paragraphs 1 and 3                      section 3.3 "foreground spatial transformation"                      section 3.4 "foreground synthesis"                      section 3.6 "foreground/background compositing"                      figures 1,2,3,4,5                      -----                      -/--</p>	5,14

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2020/030723

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>PAPANDREOU GEORGE ET AL: "Towards Accurate Multi-person Pose Estimation in the Wild", IEEE COMPUTER SOCIETY CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION. PROCEEDINGS, IEEE COMPUTER SOCIETY, US, 21 July 2017 (2017-07-21), pages 3711-3719, XP033249721, ISSN: 1063-6919, DOI: 10.1109/CVPR.2017.395 [retrieved on 2017-11-06] abstract section 1 "introduction", paragraph 4 section 3.2 "person pose estimation", paragraph 1 sub-section "OKS-based non maximum suppression" - object keypoint similarity based filtering of candidate poses figures 1,3,4</p> <p style="text-align: center;">-----</p>	5,14
T	<p>Rohit Pandey ET AL: "Volumetric Capture of Humans With a Single RGBD Camera via Semi-Parametric Learning", 2019 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 29 May 2019 (2019-05-29), pages 1-13, XP055707462, DOI: 10.1109/CVPR.2019.00994 ISBN: 978-1-7281-3293-8 Retrieved from the Internet: URL:<a href="https://arxiv.org/pdf/1905.12162v1.pdf">https://arxiv.org/pdf/1905.12162v1.pdf</a> [retrieved on 2020-06-22] the whole document</p> <p style="text-align: center;">-----</p>	1-20

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

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

1. claims: 1-6, 8, 9, 11-17, 19, 20

modification of the pose of an object in an image

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2. claim: 7

improvement of the appearance of an object in a warped image

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3. claims: 10, 18

selection of a reference image

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