[0006] If a plurality of such 3D point coordinates are derived using a triangulation technique, and these point coordinates correspond to vertices of a planar structure, then geometry information of that structure may be inferred, including lengths, slopes, areas of regions, and so forth.

[0007] It may be the case that only some but not all of a plurality of available **aerial** images are complementary for a particular triangulation task. It further may be that not all of the images are as effective as a complementary image to a selected image. There thus is a need in the art for a system ad method that defines one or more measures of suitability of an image to be complementary to a selected ("initial") image and to use such one or more measures to automatically determine the best complementary images image to the initial image among the plurality of available aerial images.

SUMMARY

[0007a] In a first aspect, the present disclosure provides a method, implemented by a digital processing system, for selecting complementary images from a plurality of images captured from distinct views and/or locations, each respective image captured from a respective camera having respective camera properties, the method comprising: accepting the plurality of images, including, for each accepted image, parameters related to the accepted image and to properties of the camera that captured the accepted image; displaying at least one of the plurality of images to a user interface of the digital processing system; accepting input from a user to select one of the accepted images to be ~~an~~a user-selected initial image, the user-selected initial image being one that shows a region of interest to the user on the user interface; accepting input from the user selecting one or more points that form a 2D geometry in the user-selected initial image indicating one or more geometric features of interest; and displaying the selected one or more points on the displayed initial image on the user interface of the digital processing system; calculating one or more selection measures for the initial image based on the user input; and automatically selecting from the accepted plurality of images, which excludes the initial image, and using an optimality criterion based on the one or more selection measures an optimal image that is complementary to the initial image for the purpose of determining one or more 3D properties of the indicated one or more geometric features.

[0007b] In a second aspect, the present disclosure provides a digital processing system comprising: an input port configured to accept a plurality of images captured from distinct views and/or locations, each respective image having been captured from a respective camera, the accepting including accepting, for each respective accepted image, respective parameters related to the respective accepted image and to properties (collectively the “camera model”) of the

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respective camera that captured the respective accepted image; a user terminal having a display screen and a user interface that enable displaying on the display screen and that that enables a user to provide input, and otherwise interact with an image displayed on the display screen; a digital image processing system coupled to the user terminal, the digital image processing system including one or more digital processors, and a storage subsystem that includes instructions that when executed by the digital processing system, cause the digital processing system to carry out a method of selecting one or more complementary images from a plurality of images accepted via the input port, the method according to the first aspect.

[0007c] In a third aspect, the present disclosure provides a non-transitory machine-readable medium comprising instructions that when executed on one or more digital processors of a digital processing systems cause carrying out a method according to the first aspect.

[0007d] In a fourth aspect, the present disclosure provides a processing system comprising: a storage subsystem; and one or more processors; wherein the storage subsystem includes a non-transitory machine-readable medium according to the third aspect.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The following drawings and the associated descriptions are provided to illustrate embodiments of the present disclosure and do not limit the scope of the invention; the scope is defined by the claims. Aspects of and advantages of this disclosure will become more readily appreciated as these aspects and advantages become better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

[0009] FIG. 1 shows a simplified flowchart of a process involving a user interacting with a digital processing system for determining one or more geometric features on an initial image, including the system carrying out a method of automatically selecting a "best" complementary image to the initial image from a provided set of images according to one or more selection criteria. The process includes providing for a user a user interface on which the user may modify a feature determined using one or more selected complementary images in order to repeat the automatically selecting a "best" complementary image until a satisfactory result is obtained.

[0010] FIG. 2 shows a simplified schematic of a process for calculating geometric complementarily, according to an embodiment of the invention.

[0011] FIG. 3 shows a simplified schematic of an intersection of camera frustums used as one viable measure of image overlap, according to an embodiment of the invention.

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CLAIMS.

We claim:

1. A method, implemented by a digital processing system, for selecting complementary images from a plurality of images captured from distinct views and/or locations, each respective image captured from a respective camera having respective camera properties, the method comprising:

accepting the plurality of images, including, for each accepted image, parameters related to the accepted image and to properties of the camera that captured the accepted image;

displaying at least one of the plurality of images to a user interface of the digital processing system;

accepting input from a user to select one of the accepted images to be ~~an~~ a user-selected initial image, the user-selected initial image being one that shows a region of interest to the user on the user interface;

accepting input from the user selecting one or more points that form a 2D geometry in the user-selected initial image indicating one or more geometric features of interest; and

displaying the selected one or more points on the displayed initial image on the user interface of the digital processing system;

calculating one or more selection measures for the initial image based on the user input; and

automatically selecting from the accepted plurality of images, which excludes the initial image, and using an optimality criterion based on the one or more selection measures an optimal image that is complementary to the initial image for the purpose of determining one or more 3D properties of the indicated one or more geometric features.

2. The method of claim 1, wherein the one or more geometric features of interest in the initial image include one of the set of features consisting of a point, a line, and a surface.

3. The method as recited in claim 1, wherein the automatically selecting includes automatically selecting from the accepted plurality of images one or more ~~additional~~ images forming ~~with the optimal image~~ an optimal set of images, the optimal set of images including the optimal image, each image of the optimal set of images being complementary to the initial image for determining 3D properties of the indicated one or more geometric features.

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4. The method as recited in claim 3, further comprising ranking some or all of the one or more images in the optimal set of images according to the optimality criterion, the ranking according to suitability for use as a complementary image to the initial image, with the highest ranked image out of the optimal set of images being the optimal image.

5. The method as recited in claim 2, further comprising:

displaying to the user the optimal image, with the one or more geometric features of interest displayed.

6. The method as recited in claim 5, wherein the automatically selecting uses as the optimality criterion an overall measure of complementarity of the initial image and the geometric feature or features to a potential optimal image, and wherein the overall measure of complementarity includes one or more specific measures and corresponding selection criteria, and wherein the one or more specific measures include one or more of a measure of the intersection between frustums, a measure of coverage, a measure of the intersection between the frustum and an estimated extrusion or arbitrary volume, a measure of angular deviation, and a measure of resolution

7. The method of claim 6, further comprising:

accepting from the user a correction of at least one of the one or more displayed geometric features of interest, such that the location of the correction can be used for determining one or more geometric properties of the geometric feature or features of interest; and

determining one or more 3D properties of the indicated geometric feature or features.

8. The method as recited in claim 7, wherein the automatically selecting includes automatically selecting from the accepted plurality of images one or more ~~additional~~ images forming ~~with the optimal image~~ an optimal set of images, the optimal set of images including the optimal image, each image of the optimal set of images being complementary to the initial image for determining 3D properties of the indicated one or more geometric features, the method further comprising:

accepting from the user a selection of one of the other images from the optimal set to be a new optimal image;

displaying to the user the new optimal image, with the one or more geometric features of interest displayed on the new optimal image;

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accepting from the user a correction of at least one of the one or more displayed geometric features of interest on the new optimal image, such that the location on the new optimal image of the correction can be used for determining the one or more geometric properties of the geometric feature or features of interest; and

determining the one or more 3D properties of the indicated geometric feature or features.

9. The method as recited in claim 8, further comprising ranking some or all of the one or more images in the optimal set of images according to the optimality criterion, the ranking according to suitability for use as a complementary image to the initial image, with the highest ranked image out of the optimal set of images being the optimal image.

10. The method of claim 9, wherein each ~~of~~ of: the accepting the input from ~~a~~ the user to select one of the accepted images; the accepting the input from the user ~~an indication,~~ indicating the one or more geometric features of interest; and the accepting from the user ~~a~~ of the correction is via a graphic user interface that displays images.

11. The method of claim 10, wherein the one or more 3D properties include the slope of a roof of a building.

12. The method of claim 7, further comprising:

accepting an indication from the user of one or more new geometric features of interest, which may be the same geometric features earlier selected in the current initial image, wherein the optimal image after the accepting the indication of one or more new geometric features of interest becomes a new initial image;

automatically selecting from the accepted plurality of images and using the optimality criterion a new optimal image that is complementary to the new initial image for the purpose of ~~deter~~ determining the one or more 3D properties; and

displaying to the user the new optimal image, with the one or more new geometric features of interest displayed.

13. The method of claim 12, further comprising:

accepting from the user a new correction of at least one of the displayed one or more new geometric features of interest, such that the location of the new correction can be used for determining one or more geometric properties of the new geometric feature or features of interest; and

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determining one or more 3D properties of the indicated new geometric feature or features.

14. A digital processing system comprising:

an input port configured to accept a plurality of images captured from distinct views and/or locations, each respective image having been captured from a respective camera, the accepting including accepting, for each respective accepted image, respective parameters related to the respective accepted image and to properties (collectively the “camera model”) of the respective camera that captured the respective accepted image;

a user terminal having a display screen and a user interface that enable displaying on the display screen and that that enables a user to provide input, and otherwise interact with an image displayed on the display screen;

a digital image processing system coupled to the user terminal, the digital image processing system including one or more digital processors, and a storage subsystem that includes instructions that when executed by the digital processing system, cause the digital processing system to carry out a method of selecting one or more complementary images from a plurality of images accepted via the input port, the method according to any one of method claims 1 to 13.

15. A non-transitory machine-readable medium comprising instructions that when executed on one or more digital processors of a digital processing systems cause carrying out a method according to any one of method claims 1 to 13.

16. A processing system comprising:

a storage subsystem; and

one or more processors;

wherein the storage subsystem includes a non-transitory machine-readable medium as recited in claim 15.

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