made by different collaborators who were both online (ie., active collaborators) at the time that the modifications were made and modifications that were made while one or more of the collaborators were offline. In the instance that the collaborators who edited the published document (e.g, a photo album) were all online, the method **100** assumes that each of the collaborators were aware of modifications made by the any one or more of the other collaborators. The merging of such modifications can then be performed by simply executing each of the modifications.

[0102] If one or more of the collaborators who edited the published document were offline, then the collaborators may have been attempting to make the same modification. In this instance, the merging of the modifications to the document accounts for the users being offline. In particular, modifications to different images of the document are independent just as changes to different parameters of the same image of the document are considered to be independent. However, modifications made to the same parameter of the same image of the document are not considered to be independent. In this instance, an average of the result of the simultaneous modification can be determined. As will be explained in more detail below, such an average can be determined for two or more collaborators of the originally published document.

[0103] Further, modifications can be commutative so that the result of the modifications does not depend on the order in which the modifications are performed. In this instance, if only one modification to a parameter of an image object is requested, then that change can simply be executed as requested.

[0104] An example of combining modifications in a document is the addition of modifications to the position vector of an image object and the addition of the resultant of modification to the position of the object. A further example, is the multiplication of scale factors together before scaling an object by the result of the modification. A still further example, is the addition of angles of rotation and the rotation of the object by the resulting angle.

[0105] An example of averaging modifications to an object includes taking the weighted arithmetic mean of modifications to the position vector of the object and adding the resultant mean value to the position of the object. Further averaging examples include the calculation of a weighted geometric mean of scale factors for an object before scaling the object by the resultant mean; or taking the weighted mean of rotation angles of an object and rotating the object by the resultant mean.

[0106] A weighted arithmetic mean $\bar{x}$ can be determined in accordance with the described methods as follows:

$$\bar{x} = \frac{\sum_i w_i x_i}{\sum_i w_i} \tag{1}$$

[0107] where x_i represents the value of the object parameters (i.e., position, rotation and scale) and w_i represents weights associated with the collaborators who approved each different version of a corresponding document.

[0108] A weighted geometric mean can be calculated in accordance with the described methods as follows:

$$\bar{x} = \left(\prod_i x_i^{w_i}\right)^{1/\sum_i w_i} \tag{2}$$

[0109] where again x_i represents the values of the object parameters and the weights, w_i, are associated with the collaborators who approved each different version of a corresponding document. Different weights can be assigned to different modifications made to an originally published document, such that the opinion of a particular collaborator is considered more valuable than the opinion of another, for example.

[0110] An alternative to taking weighted averages of modifications made to a particular object as described above is to use weights to vote on a preferred modification to an object, such that document modifications are merged by election. As an example, for a document edited by two different collaborators, let:

[0111] $x_{v,j}$: represent the position of the j^{th} image of the v^{th} version of the document;

[0112] $s_{v,j}$: represent the scale factor of the j^{th} image of the v^{th} version of the document;

[0113] $r_{v,j}$: represent the rotation angle of the j^{th} image of the v^{th} version of the document;

[0114] old: represent the last common version of the document that the two different collaborators had in common; and

[0115] labels 1 and 2: represent conflicting versions of the document.

[0116] Assume three collaborators (i.e., one of the authors of the original document and two other collaborators) approved version 1 of the document, but only one collaborator (i.e., the same author) has approved version 2 of the document. Any change to an image parameter that was made by only one of the collaborators can be accepted in accordance with the change. However, if more than one collaborator has changed the position, scale factor, and rotation angle of the j^{th} image, then the weighted arithmetic mean of the modifications can be used to determine a value for the first and third parameter of the document.

[0117] For example, the position and rotation parameter for a resultant document can be determined by using ¾ of the position and rotation parameter value for the 1^{st} version of the document plus ¼ of the position and rotation parameter value for the 2^{nd} version of the document as follows:

$$\left(\frac{3}{4}r_1 + \frac{1}{4}r_2\right) \tag{3}$$

[0118] The scale factor for the j^{th} image of the resultant document can be determined by determining a weighted geometric mean of the edited scale factors for the 1^{st} and 2^{nd} version of the document. The weighted geometric mean can