

CLAIMS

What is claimed:

1. A method for providing face mesh deformation with detailed wrinkles, the method performed by a computer system, the method comprising:
 - receiving a neutral mesh and a plurality of initial control point positions on the neutral mesh, wherein the neutral mesh is based on a three-dimensional scanned image of a face;
 - receiving a plurality of user-defined control point positions corresponding to a non-neutral facial expression;
 - generating a radial basis function (RBF) deformed mesh based on RBF interpolation of the initial control point positions and the user-defined control point positions;
 - generating predicted wrinkle deformation data based on the RBF deformed mesh and the user-defined control points, wherein the predicted wrinkle deformation data is generated by one or more cascaded regressors networks; and
 - providing, for display on a client device within a user interface, a final deformed mesh comprising wrinkles based on the predicted wrinkle deformation data.
2. The method of claim 1, wherein the RBF interpolation corresponds to computed diffusion flows representing the Gaussian kernel of the geodesic distance between the initial control point positions and all other vertices in the neutral mesh.
3. The method of claim 1, wherein the RBF deformed mesh is further based on a spline interpolation of the initial control point positions and the user-defined control point positions, the spline interpolation being performed prior to the RBF interpolation.
4. The method of claim 1, wherein the one or more cascaded regressors networks are trained on a plurality of training examples, wherein each of the training examples comprises an example RBF deformed mesh.
5. The method of claim 4, wherein each of the training examples further comprises a segmentation mask generated by segmenting the example RBF deformed mesh into a

plurality of unique facial regions, and wherein a cascaded regressors network is trained on each unique facial region.

6. The method of claim 1, wherein the one or more cascaded regressors networks comprise a displacement regressor configured to predict initial vertices displacement data.

7. The method of claim 6, further comprising:
providing, for display on the client device within the user interface, a preview deformed mesh comprising wrinkles based on the predicted initial vertices displacement data, wherein the preview deformed mesh is provided for display in real-time or substantially real-time upon the displacement regressor predicting the initial vertices displacement data.

8. The method of claim 1, further comprising:
computing local deformation gradient tensors around the user-defined control point positions; and
converting the local deformation gradient tensors to Lie tensors,
wherein the one or more cascaded regressors networks comprise a deformation gradient regressor configured to predict deformation gradient tensors based on the Lie tensors.

9. The method of claim 8, further comprising:
converting the predicted deformation gradient tensors into vertex coordinates of the RBF deformed mesh.

10. The method of claim 1, further comprising:
mapping the initial control point positions onto a hyperspace defined from a plurality of previous RBF deformed meshes;
computing distances between the mapped initial control point positions to the user-defined control point positions; and
providing, for display on the client device within the user interface, the distances and the mapped initial control point positions as visual feedback guidance.

11. The method of claim 1, further comprising:

mapping the wrinkle deformation data onto one or more additional meshes based on three-dimensional scanned images of an additional face.

12. The method of claim 1, further comprising:

providing, for display on the client device in the user interface, one or more Facial Action Coding System (FACS) normalized meshes based on the final deformed mesh, wherein the predicted wrinkle deformation data is independent and removed from each of the one or more FACS normalized meshes.

13. The method of claim 1, further comprising:

providing, for display on the client device in the user interface, a plurality of swappable facial textures, wherein the swappable facial textures each comprise wrinkles aligned with at least one of the wrinkle deformation data and the final deformed mesh.

14. A non-transitory computer-readable medium containing instructions for providing face mesh deformation with detailed wrinkles, the instructions for execution by a computer system, the non-transitory computer-readable medium comprising:

instructions for receiving a neutral mesh and a plurality of initial control point positions on the neutral mesh, wherein the neutral mesh is based on a three-dimensional scanned image of a face;

instructions for receiving a plurality of user-defined control point positions corresponding to a non-neutral facial expression;

instructions for generating a radial basis function (RBF) deformed mesh based on RBF interpolation of the initial control point positions and the user-defined control point positions;

instructions for generating predicted wrinkle deformation data based on the RBF deformed mesh and the user-defined control points, wherein the predicted wrinkle deformation data is generated by one or more cascaded regressors networks; and

instructions for providing, for display on a client device within a user interface, a final deformed mesh comprising wrinkles based on the predicted wrinkle deformation data.

15. The non-transitory computer-readable medium of claim 14, wherein the RBF interpolation corresponds to computed diffusion flows representing the Gaussian kernel of

the geodesic distance between the initial control point positions and all other vertices in the neutral mesh.

16. The non-transitory computer-readable medium of claim 14, wherein the one or more cascaded regressors networks are trained on a plurality of training examples, wherein each of the training examples comprises an example RBF deformed mesh.

17. The non-transitory computer-readable medium of claim 14, wherein each of the training examples further comprises a segmentation mask generated by segmenting the example RBF deformed mesh into a plurality of unique facial regions, and wherein a cascaded regressors network is trained on each unique facial region.

18. The non-transitory computer-readable medium of claim 14, wherein the one or more cascaded regressors networks comprise a displacement regressor configured to predict initial vertices displacement data.

19. The non-transitory computer-readable medium of claim 18, further comprising:
instructions for providing, for display on the client device within the user interface, a preview deformed mesh comprising wrinkles based on the predicted initial vertices displacement data, wherein the preview deformed mesh is provided for display in real-time or substantially real-time upon the displacement regressor predicting the initial vertices displacement data.

20. The non-transitory computer-readable medium of claim 14, further comprising:
instructions for computing local deformation gradient tensors around the user-defined control point positions; and
instructions for converting the local deformation gradient tensors to Lie tensors,
wherein the one or more cascaded regressors networks comprise a deformation gradient regressor configured to predict deformation gradient tensors based on the Lie tensors.