Surrey 3D Face Model — file types

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The representation of the facial surface is a triangle mesh, built up from vertices (points in space) and triangles over triplets of vertices. Texture is provided as one colour value per vertex. Every vertex has a unique ID (number). The vertex numbers and triangles are constant over all faces generated by the model (so vertex number 35 marks the chin tip, always).

1 Shape and Texture Models (*.scm)

The shape model describes the statistical variation of vertex positions, *i.e.*, variations in their x, y and z coordinates, around the mean position. Equally, the texture model describes the variation of vertex colours (red, green and blue).

To this purpose the face shape and texture are vectorised. A shape vector describes the x, y and z coordinates of all N vertices in sequence: $[x_1, y_1, z_1, \ldots, x_N, y_N, z_N]$. And the texture vector follows: $[r_1, g_1, b_1, \ldots, r_N, g_N, b_N]$.

The layout of an *.scm file is as follows (little-endian byte order). Note that an unsigned int is 4 bytes and a double is 8 bytes.

1. unsigned int: the number of vertices: N

2. unsigned int: the number of triangles: M

3. $3M$ unsigned ints: the triangles as triplets of vertex indices.

4. The shape PCA model:

   (a) unsigned int: the number of components: S

   (b) unsigned int: the length of a basis vector: $D = 3N$

   (c) SD doubles: the matrix of principal components as S sequences of D vectors in order. Each vector is in the format defined above.

   (d) unsigned int: the length of a basis vector, again (D).

   (e) D doubles: the mean shape vector in the format defined above.

   (f) unsigned int: the number of eigenvalues (should sensibly be S).

(g) S doubles: the eigenvalues in the order matching the principal components.

5. The texture PCA model. This is defined in exactly the same way as the shape model. The number of texture components is independent of the number of shape components, however.

2 Facial Regions (`*.bin`)

A set of files is provided that mark distinct regions of the facial surface. The files are binary, each made up of a series of values of type "int". The first int gives the number of triangles in the file. Each subsequent int is an index number of one triangle.

EyesTri.bin indices of the triangles that make up the eye sub-region.

NoseTri.bin indices of the triangles that make up the nose sub-region.

MouthTri.bin indices of the triangles that make up the mouth sub-region.

RestMTri.bin indices of the triangles that make up the rest sub-region.

EyeballsTri.bin indices of the triangles that make up the eye whites.

3 Landmarks

A set of useful landmark points are shown in Figure 1. Table 1 lists the corresponding vertex numbers in the Surrey 3D Face Model. The vertex numbers are valid for models of all resolutions, except those above 1000 — these may not exist in some of the lowest resolution variants.

In general, the landmarks are listed in order of importance. This "importance" was determined empirically. For instance, if you want to annotate the minimum number of landmarks, you would use the first 4 in the list (these four are distributed in a way that helps to estimate the size of the face and align the principal features). You will get more accurate registrations as you add landmarks (always adding them in a left-right symmetrical fashion). Most of the landmarks at the end of the list are on the mouth region because they were added to increase accuracy when expressions are present.

Description	Diagram Number	Vertex number
Right eye outer corner	1	177
Left eye outer corner	2	610
Nose tip	3	114
Chin tip	4	35
Right eye inner corner	5	181
Right eye middle top	6	1125
Right eye middle bottom	7	1180
Left eye inner corner	8	614
Left eye middle top	9	2368
Left eye middle bottom	10	2425
Nose bridge	11	438
Right mouth corner	12	398
Left mouth corner	13	812
Upper lip middle top	14	329
Upper lip middle bottom	15	423
Lower lip middle top	16	442
Lower lip middle bottom	17	411
Right eyebrow outer corner	18	225
Right eyebrow inner corner	19	157
Right eyebrow middle	20	233
Right nose-cheek junction	21	79
Left eyebrow outer corner	22	658
Left eyebrow inner corner	23	590
Left eyebrow middle	24	666
Left nose-cheek junction	25	516
Chin dip	26	332
Quarter forehead	27	295
Nose middle	28	379
Nose-lip junction	29	270
Middle forehead	30	440
Upper lip right quarter top	31	314
Upper lip right quarter bottom	32	416
Lower lip right quarter top	33	404
Lower lip right quarter bottom	34	263
Upper lip left quarter top	35	735
Upper lip left quarter bottom	36	828
Lower lip left quarter top	37	817
Lower lip left quarter bottom	38	692
Right ear-jaw junction	39	359
Left ear-jaw junction	40	776

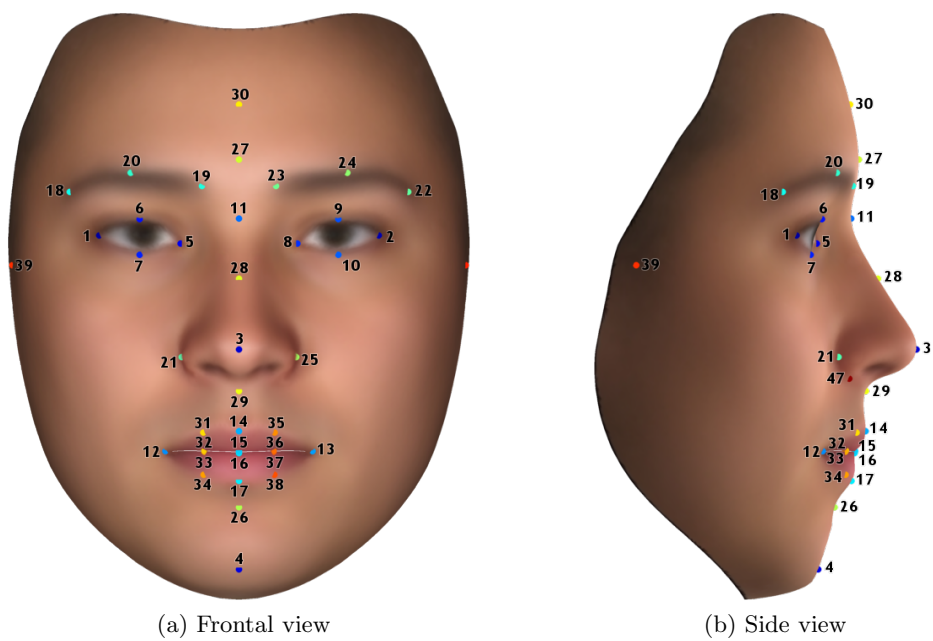Table 1: A list of forty facial landmarks with their vertex ID in the Surrey 3D Face Model.

(a) Frontal view

(b) Side view

Figure 1: Forty facial landmarks superimposed.