

Final Project

Facial Animation Retargeting using a Simple Machine Learning Technique

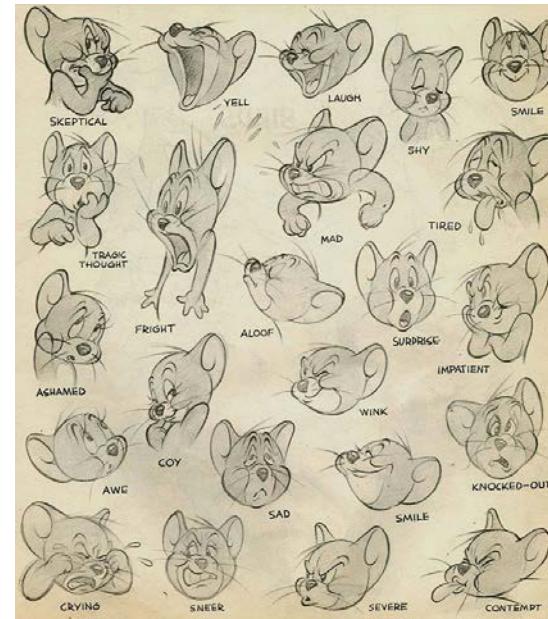
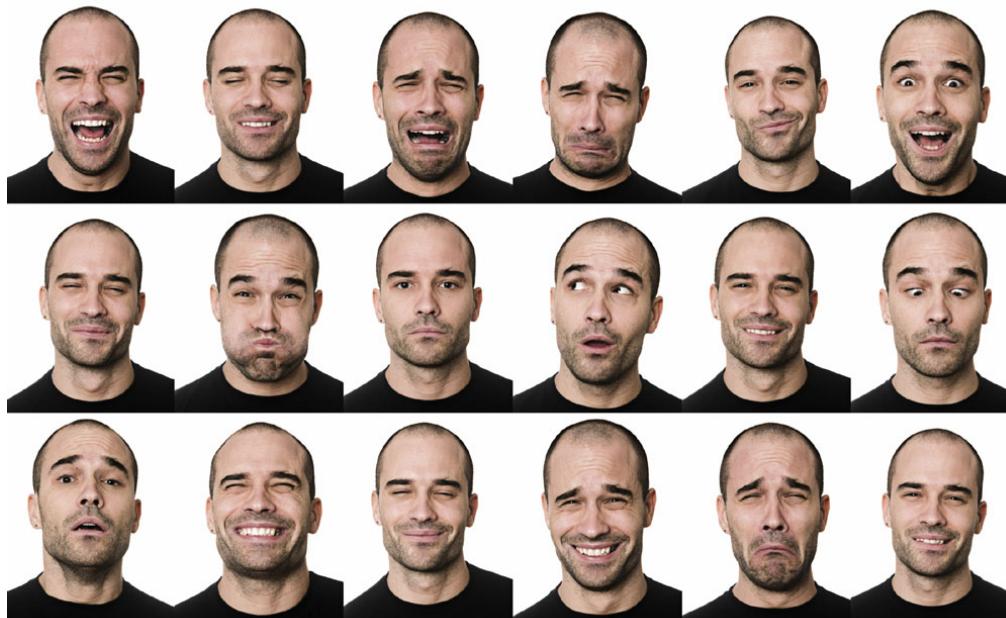
2018 Fall, GCT522, Computer Graphics Theory and Application

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2018-10-15

Motivation

- Facial expression is most significant feature of human communication. [Albert Mehrabian, 1970]



Motivation

- Previous ways to make facial animation
 - Keyframing



Motivation

- Previous ways to make facial animation

- Keyframing
- Motion capture
 - Retargeting to non-humanoid character is hard

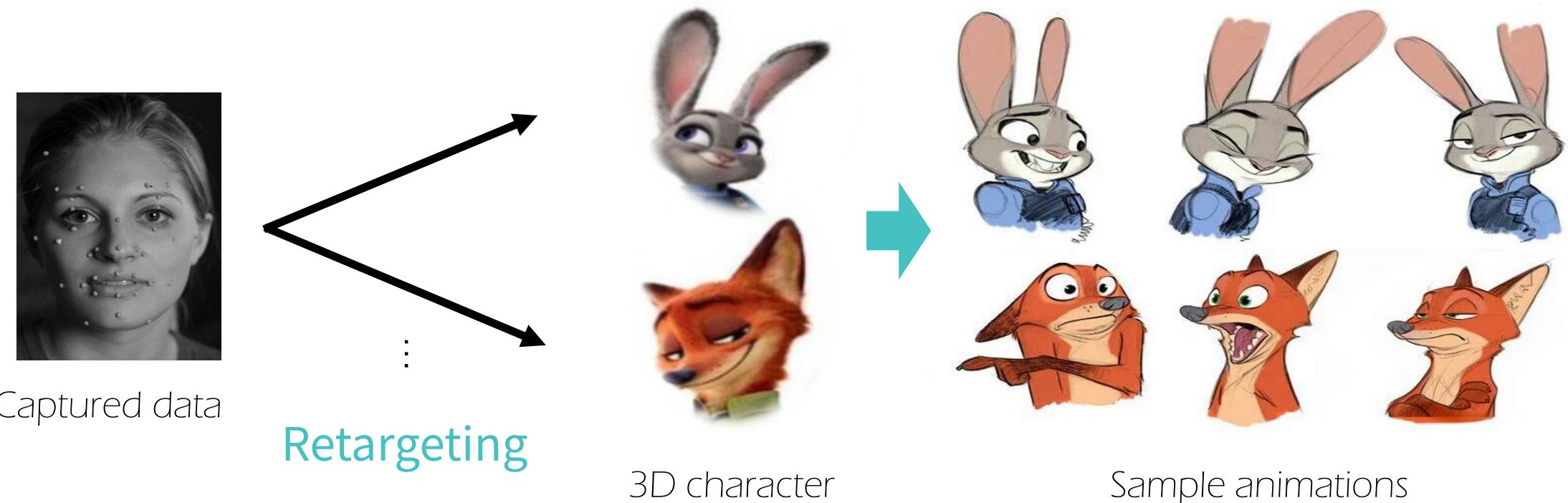


Retargeting



Goal

To generate various characteristic facial animations from a single motion data



Characteristic Facial Retargeting

J. Song, B. Choi, Y. Seol, J. Noh

Journal of Computer Animation and Virtual Worlds, 2010

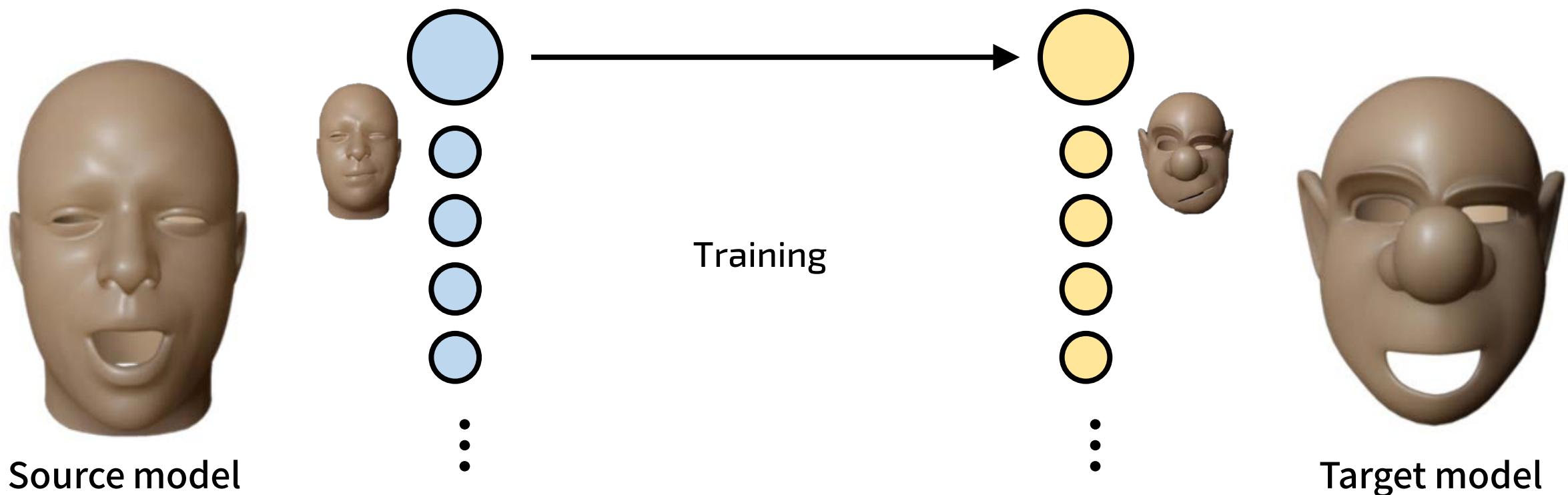
Characteristic Facial Retargeting

J. Song, B.



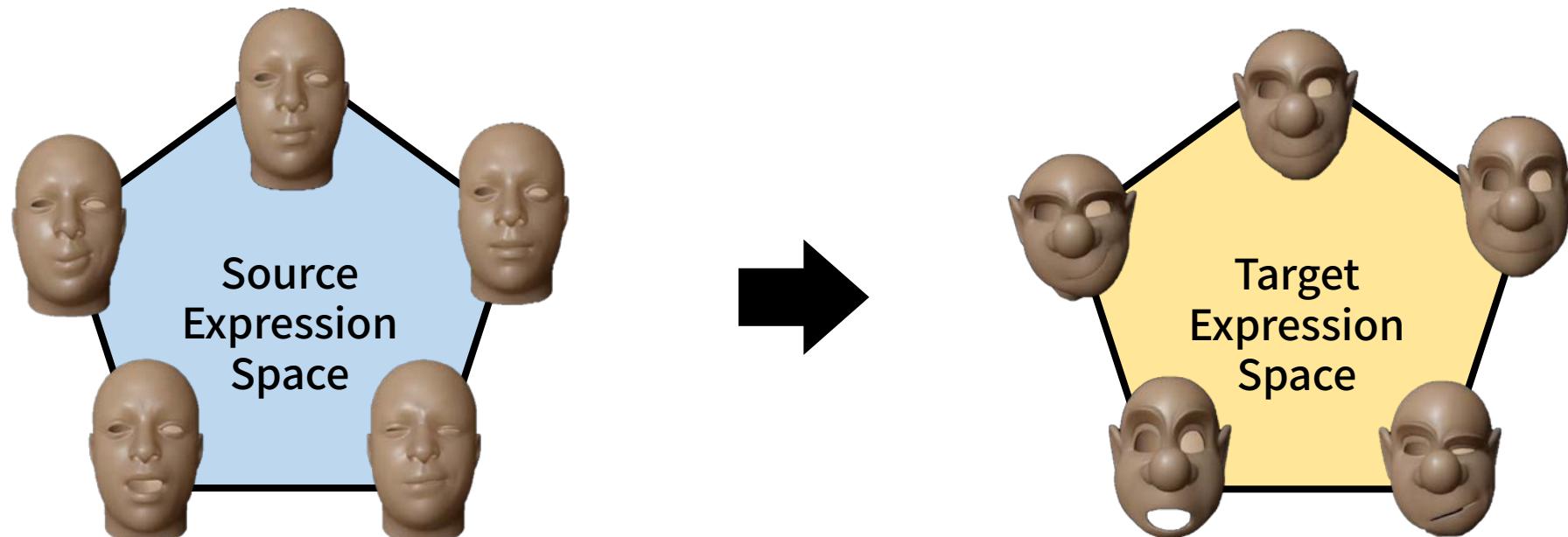
Retargeting

- Data-driven approach



Retargeting

- Expression pair



$$S = (ws_1, ws_2, ws_3, \dots, ws_{ns})$$

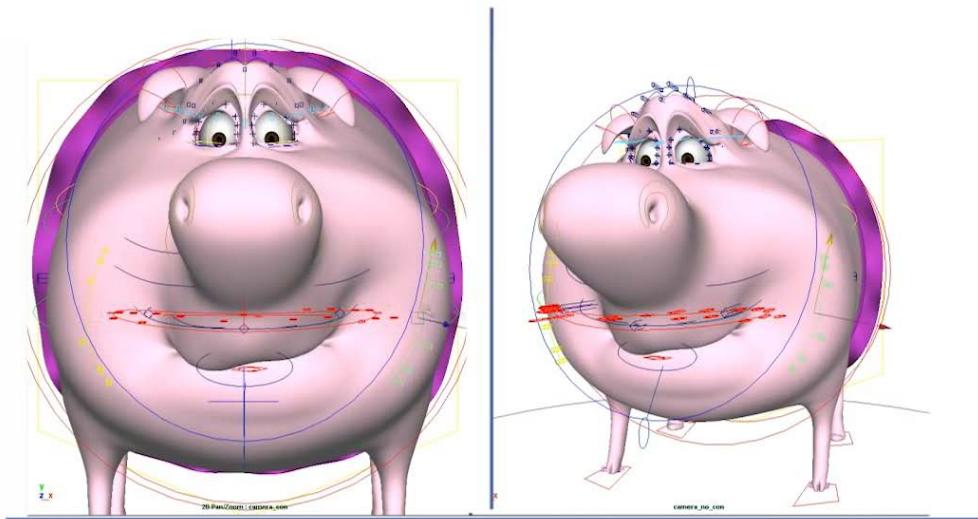
ws : blendshape weight

$$T = (cv_1, cv_2, cv_3, \dots, cv_{nt})$$

cv : self defined general basis

Retargeting

- Control Vector

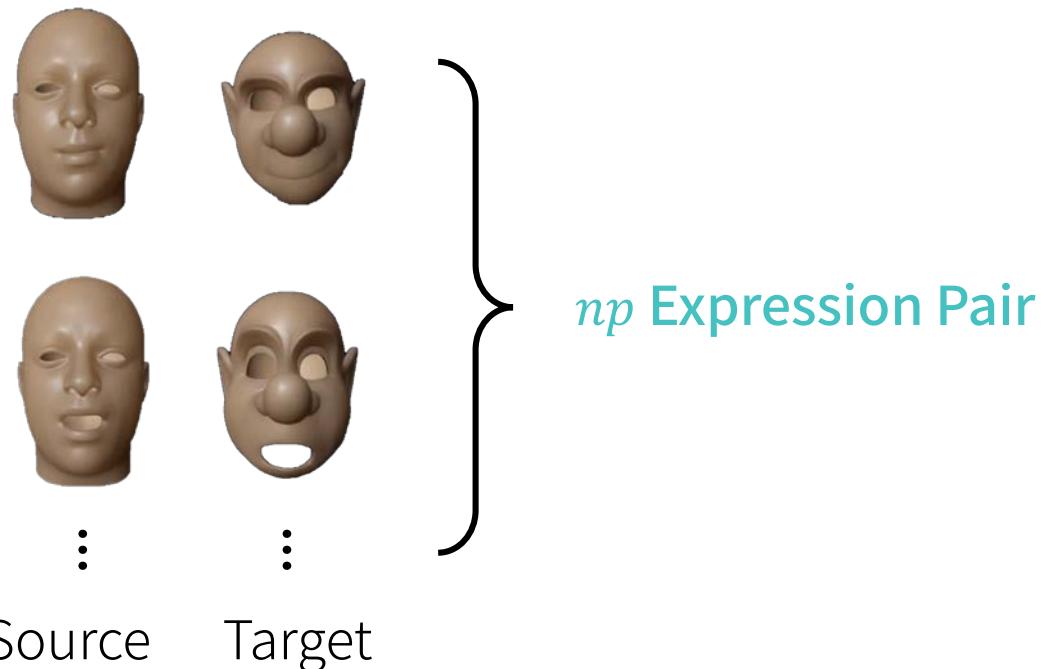


General basis CVs

{

- Joints
- Deformers
- Blendshapes
- Controllers
- ...

Retargeting



$$\mathbf{S} = \begin{pmatrix} w_1^1 & w_2^1 & \dots & w_{ns}^1 \\ \vdots & \vdots & \ddots & \vdots \\ w_1^{np} & w_2^{np} & \dots & w_{ns}^{np} \end{pmatrix}$$
$$\mathbf{T} = \begin{pmatrix} \mathbf{cv}_1^1 & \mathbf{cv}_2^1 & \dots & \mathbf{cv}_{nt}^1 \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{cv}_1^{np} & \mathbf{cv}_2^{np} & \dots & \mathbf{cv}_{nt}^{np} \end{pmatrix}$$

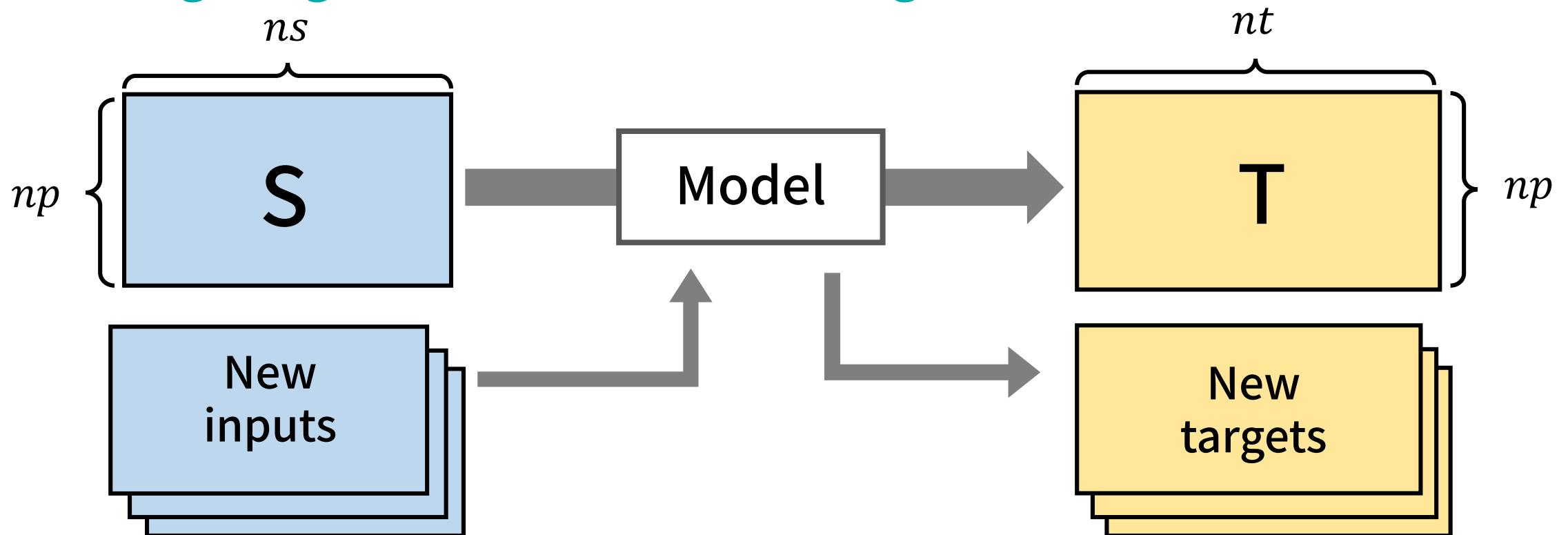
w : blendshape weight

\mathbf{cv} : control vectors

np : number of the range of expression pairs

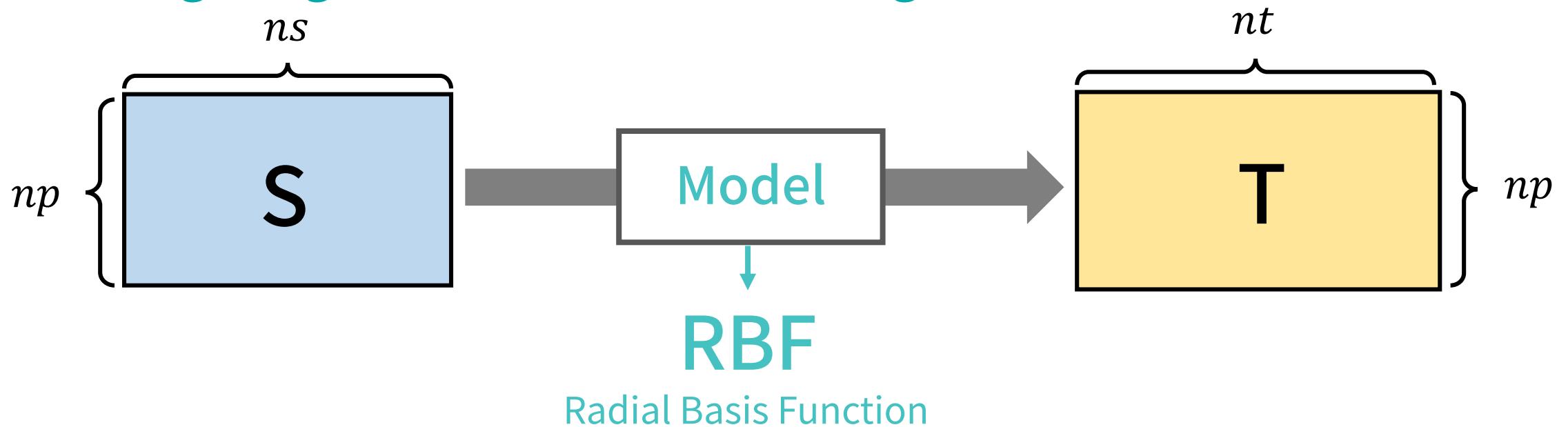
Retargeting

- Retargeting model based on the regression



Retargeting

- Retargeting model based on the regression



Grading Policy (30 Points)

1. Implementation 20 pts

2. Output visual quality 5 pts

3. Presentation 5 pts

The Given Framework

You are given source codes, with an already created framework. You have to complete the missing areas.

The code is commented and it is indicated where you need to complete the code.

Implement 4 Maya Commands and 1 Algorithm

Source Expression Pair Data Generation

FRR_blendExport.cpp **FRRBlendExport** -bn "blendNodeName.dat" -bfm "blend_ROE_FileName.dat" -f frameNumber

Target Expression Pair Data Generation

FRR_CVExport.cpp **FRRCVExport** -cln "CtrlListFileName.dat" "CV_ROE_FileName.dat" -f frameNumber

Target Final Result Animation Import

FRR_CVImport.cpp **FRRCVImport** -cln "kokoCtrlList.dat" -ffn "kokoFinalResult.dat"

Target Final Retargeting Data Generation

FRR_Training.cpp **FRRTraining** -bfm "Blend_ROE_FileName.dat" -cfm "CV_ROE_FileName.dat" -sfm "SourceFileName.dat"

RBF

rbfKernel.cpp (Radial Basis Function)

The Given Files

Source Pair Data Scene File

HumanBROE.mb (source range of expression Maya scene file)

Target Pair Data Scene File

kokoCROE.mb (target range of expression Maya scene file)

Target Controller List File

kokoCtrlList.dat (target facial rig controller list file)

Source Animation Data

humanSourceAnimation.mb (source animation for retargeting via RBF training)

Target Scene File

koko.mb (target character original Maya scene file)

Workflow

1) Export the source & target expression pairs, source animation

- HumanBROE.mb, kokoCROE.mb, kokoCtrlList.dat, humanSourceAnimation.mb

2) Train RBF Model & Get the resulting target animation

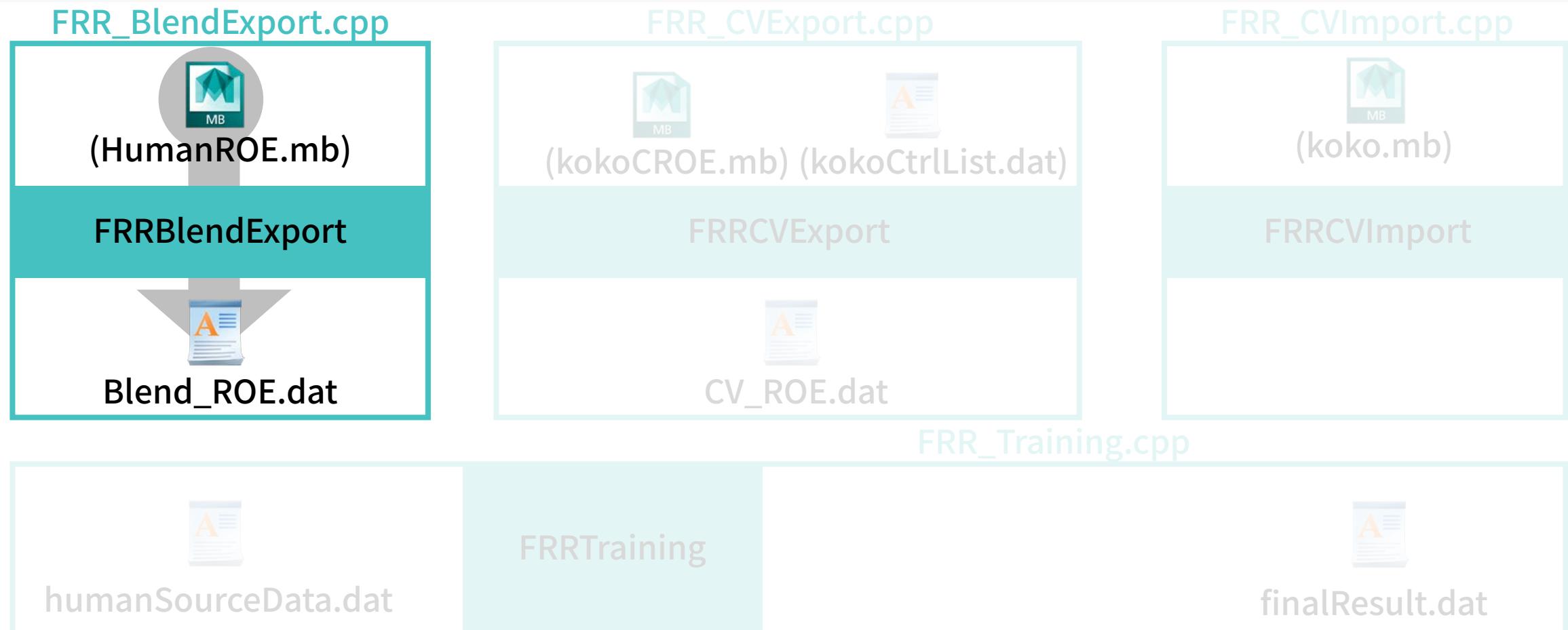
- Using created .dat files

3) Import the final target animation

- koko.mb, kokoCtrlList.dat

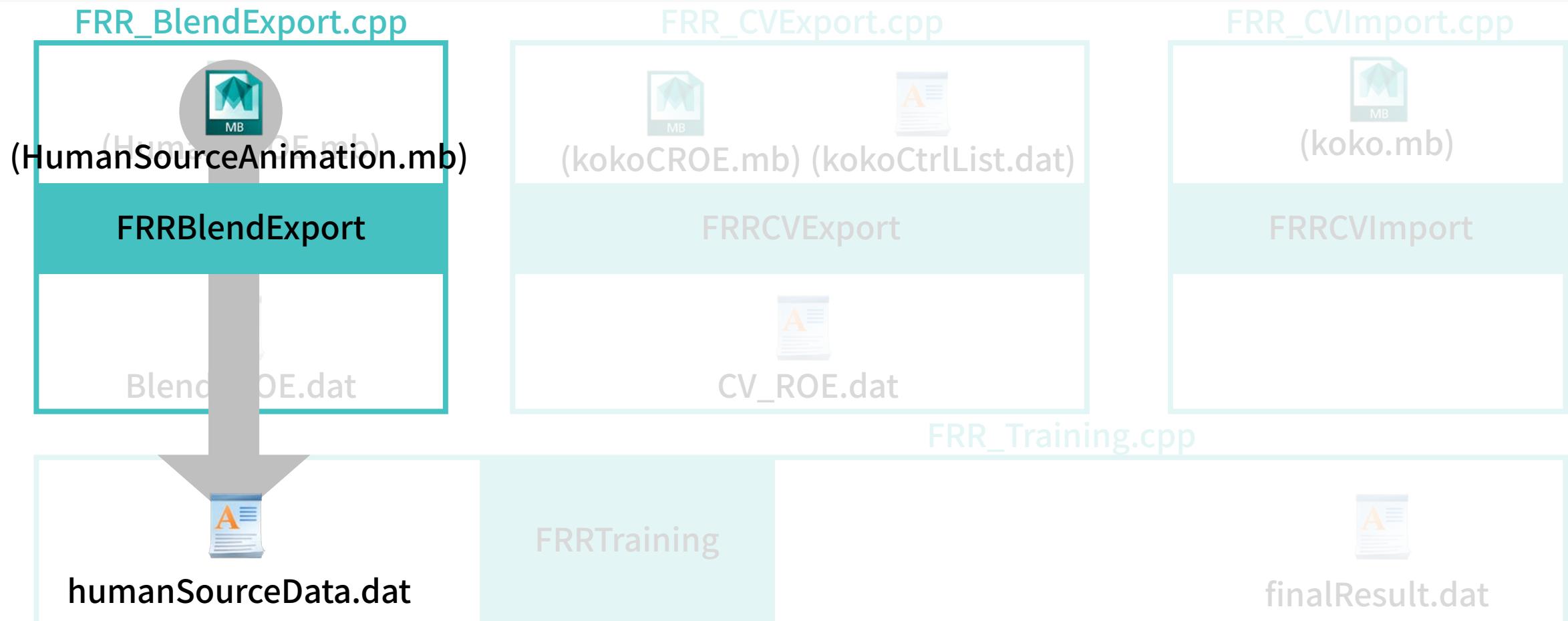
Framework

※ (file) means given file.



Framework

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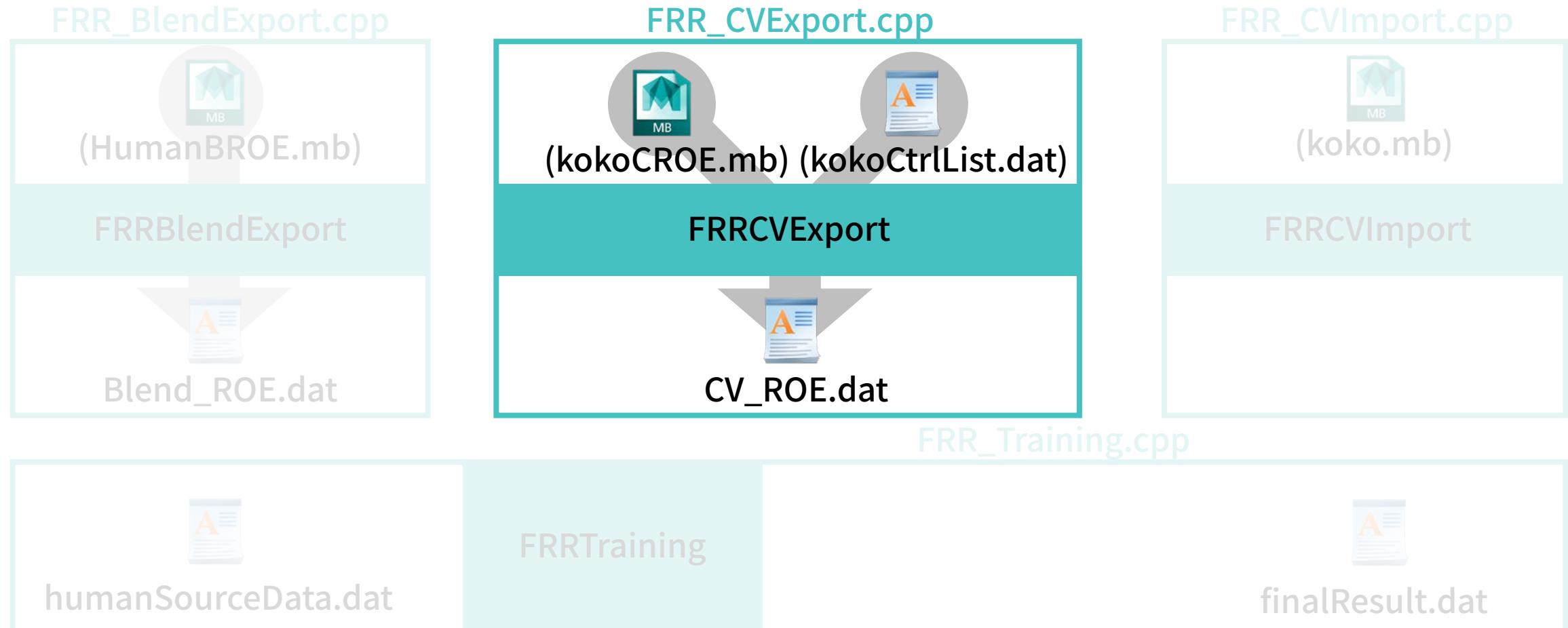
Framework

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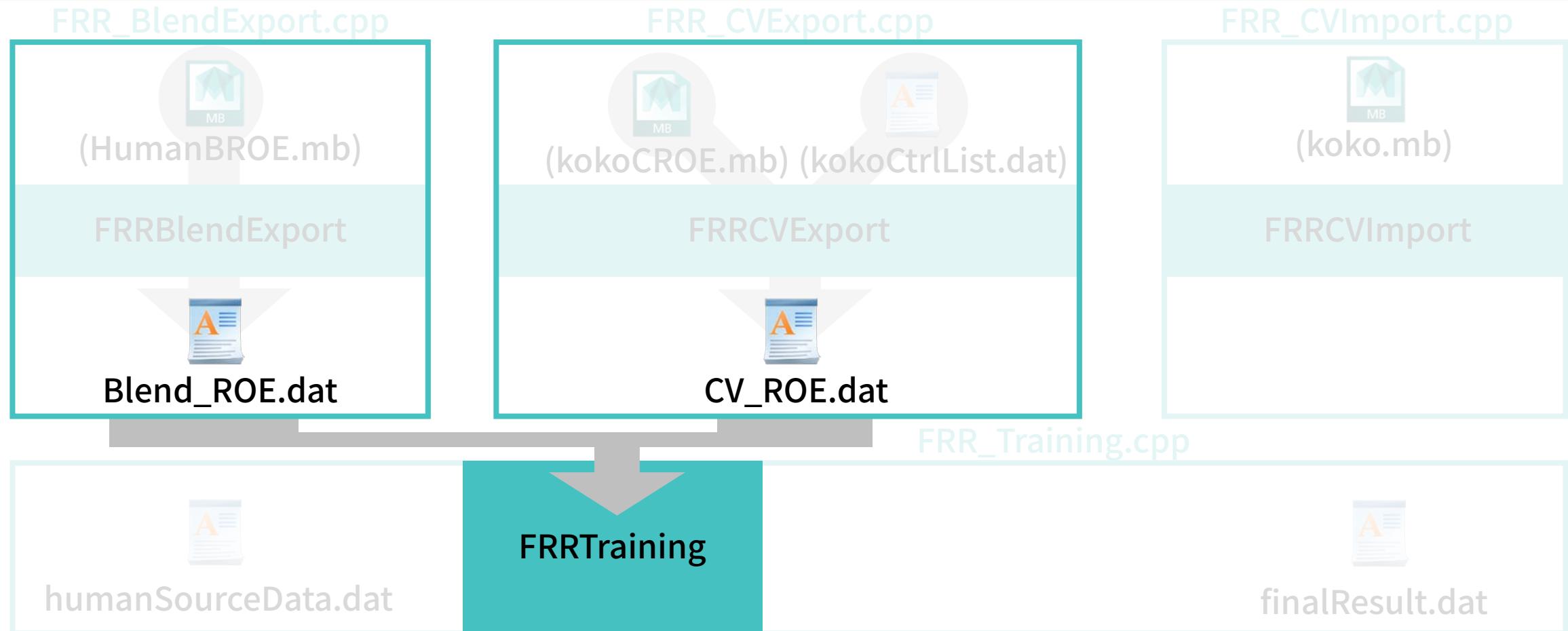
Framework

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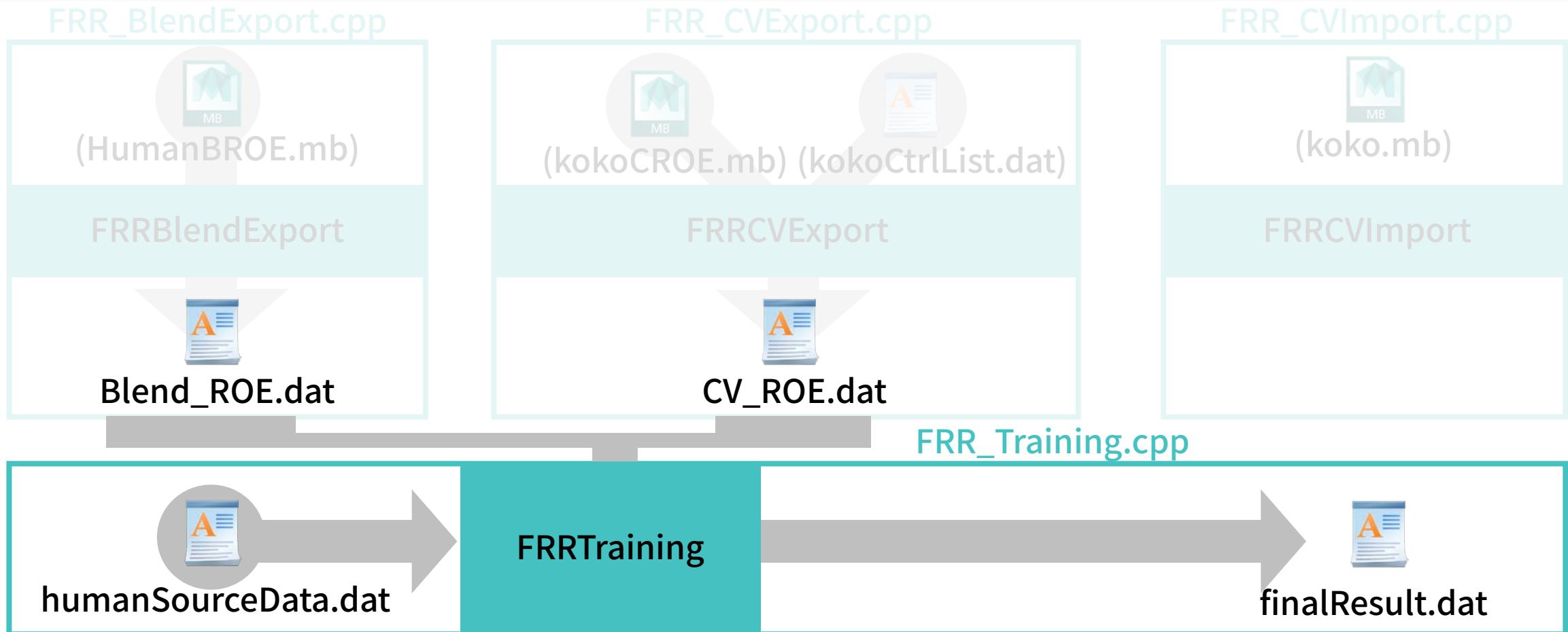
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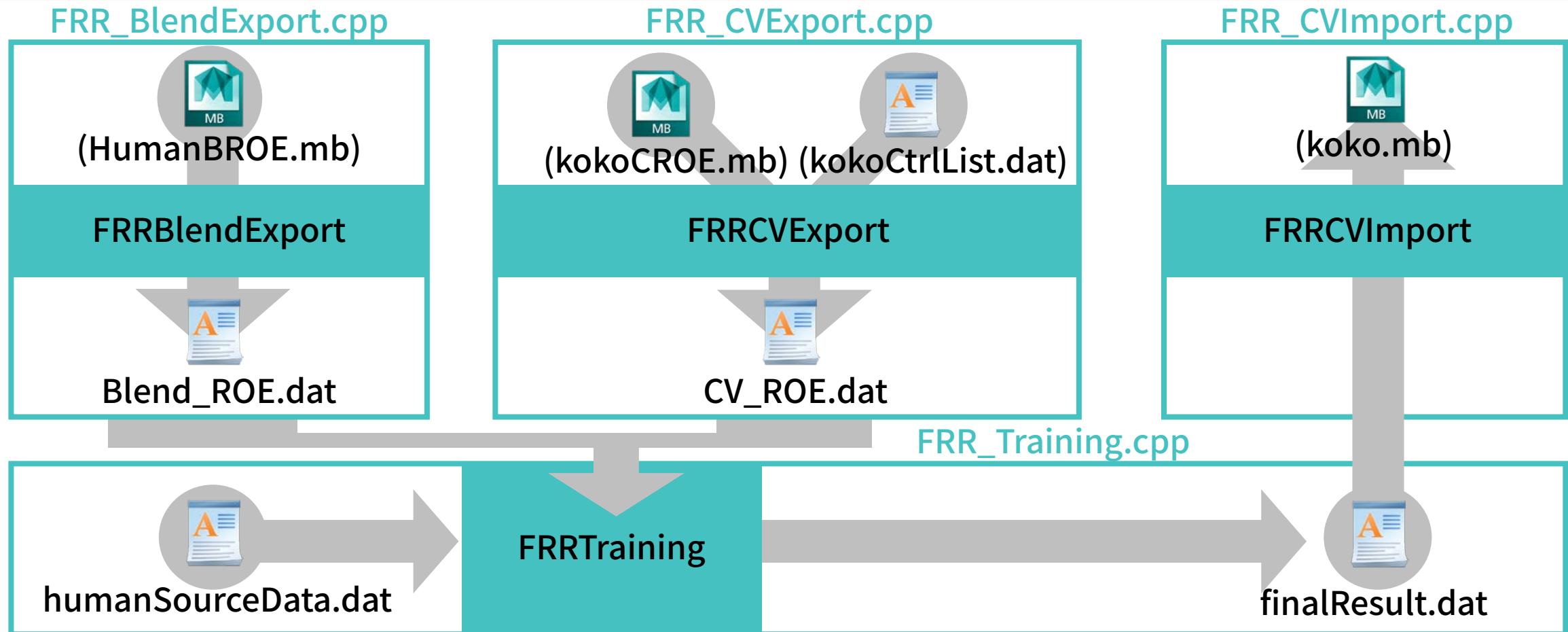
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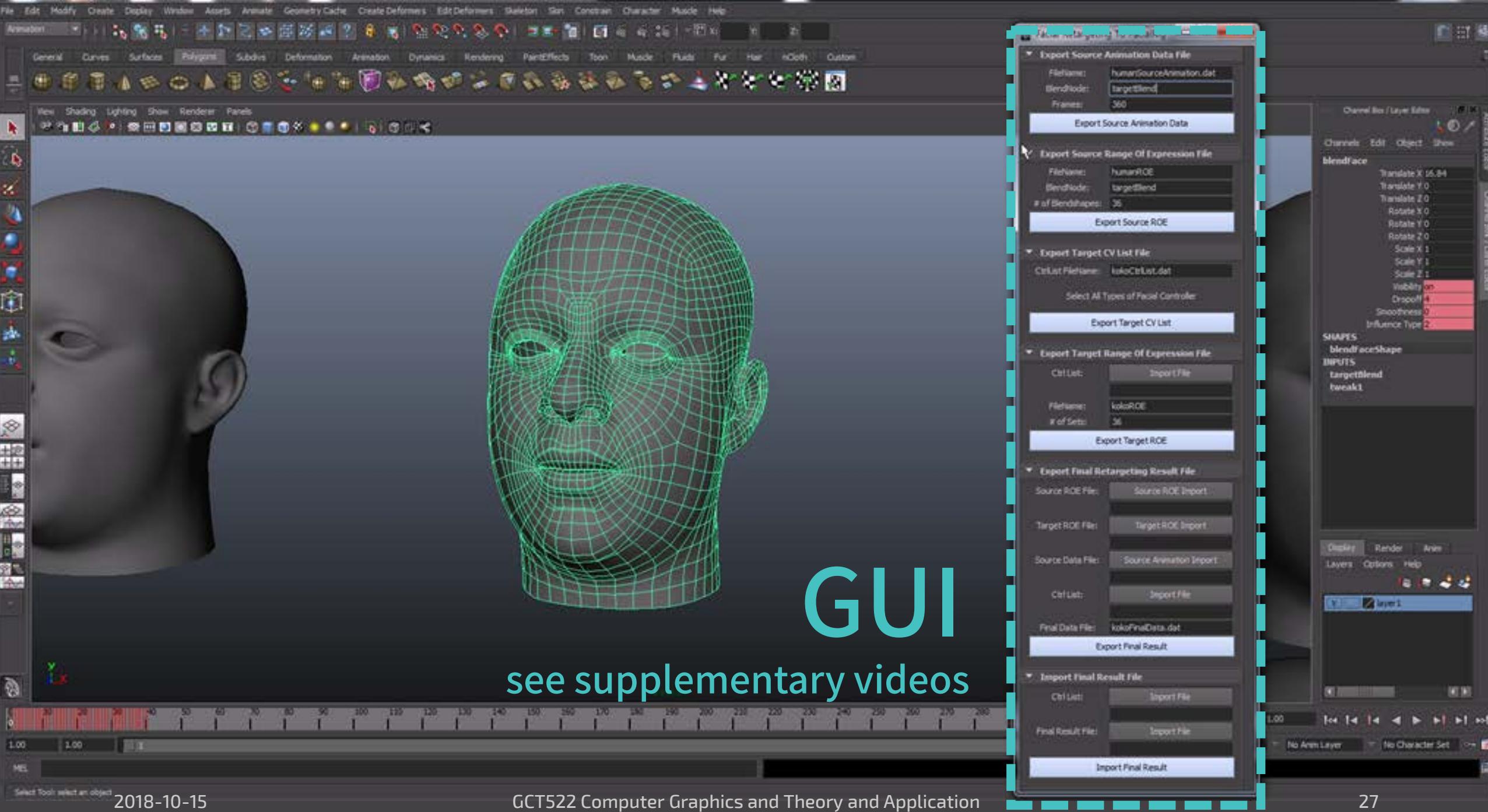
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Framework

Video



GUI
see supplementary videos

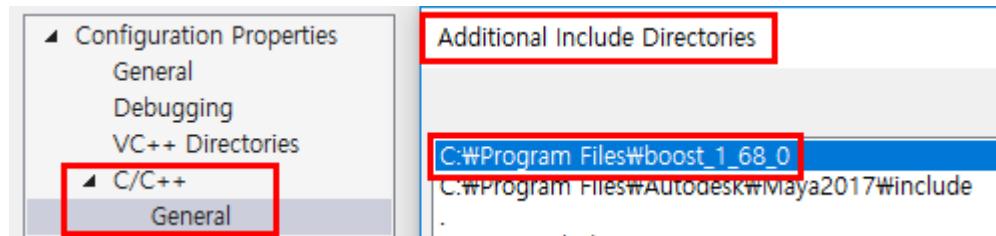
Score Break Down (Implementation : 20 Points)

• User Interface	1 pts
• GUI	+1 pts
• Data Generation	7 pts
• FRR_blendExport.cpp	+3 pts
• FRR_CVExport.cpp	+4 pts
• RBF in RBFKernel.cpp/h	4 pts
• rbfKernel.cpp	+4 pts
• Data out	8 pts
• FRR_Training.cpp	+4 pts
• FRR_CVImport.cpp	+4 pts

Etc.

- You should use **BOOST** library for this project.

- Boost download & build
 - <https://www.boost.org/users/download/>
 - <https://codeyarns.com/2014/06/06/how-to-build-boost-using-visual-studio/>
- VS Project property
 - You can just add the boost_(version) file directory to the Additional Include Directories(C/C++ > General)
 - Ex)



Etc.

(Output visual quality : 5 Points)

- For the final demo, you can use your own source animation data or target character from the internet.

- If you want to use a new target character, you need to keyframing for a range of expression corresponding the source ROE using controllers of the target character.
- For a controller list file(.dat) of the new target character, you can use ‘FRRCtrlListExport’ command(given code) after selecting the controllers(See the supplementary video about this process).
- You can also make your own source animation by key-framing to make the final demo video.

Etc.

1) Read the paper

- Characteristic Facial Retargeting
- <http://vml.kaist.ac.kr/main/international/individual/41>

2) Do your homework #4 (Blendshape)

3) Do this final project

Final Project

- **Due date**

23:00, Sunday, Dec. 9th, 2018

- **Submission files**

- 1) **Source code:** sln / .cpp / .h / .vcproj ... (To reduce size please clean your solution)
- 2) **UI code:** .py file
- 3) **compiled binary file :** .mll file
- 4) **output video files**
- 5) **presentation materials**
- 6) **readme file:** Target Machine & software (ex. Maya 17 x64)
How to use your Command (if you don't provide UI)

- **Demonstration policy**

You should present your project! Prepare some nice demo video :-)

Q/A

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