

3D Facial Matching by Spiral Convolutional Metric Learning and a Biometric Fusion-Net of Demographic Properties

Soha Sadat Mahdi*, Nele Nauwelaers*, Philip Joris, Giorgos Bouritsas, Shunwang Gong, Sergiy Bokhnyak, Susan Walsh, Mark D. Shriver, Michael Bronstein, Peter Claes

Problem Statement



Problem Statement



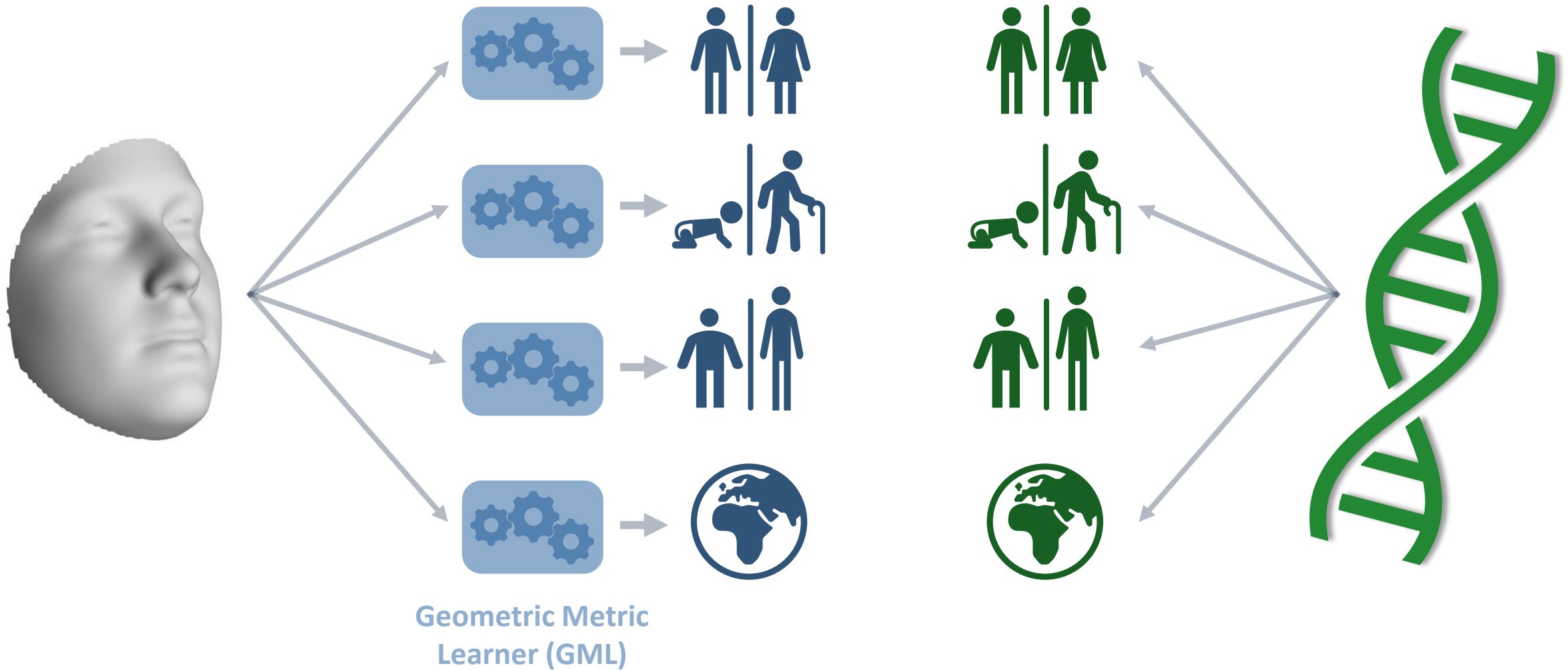
Problem Statement



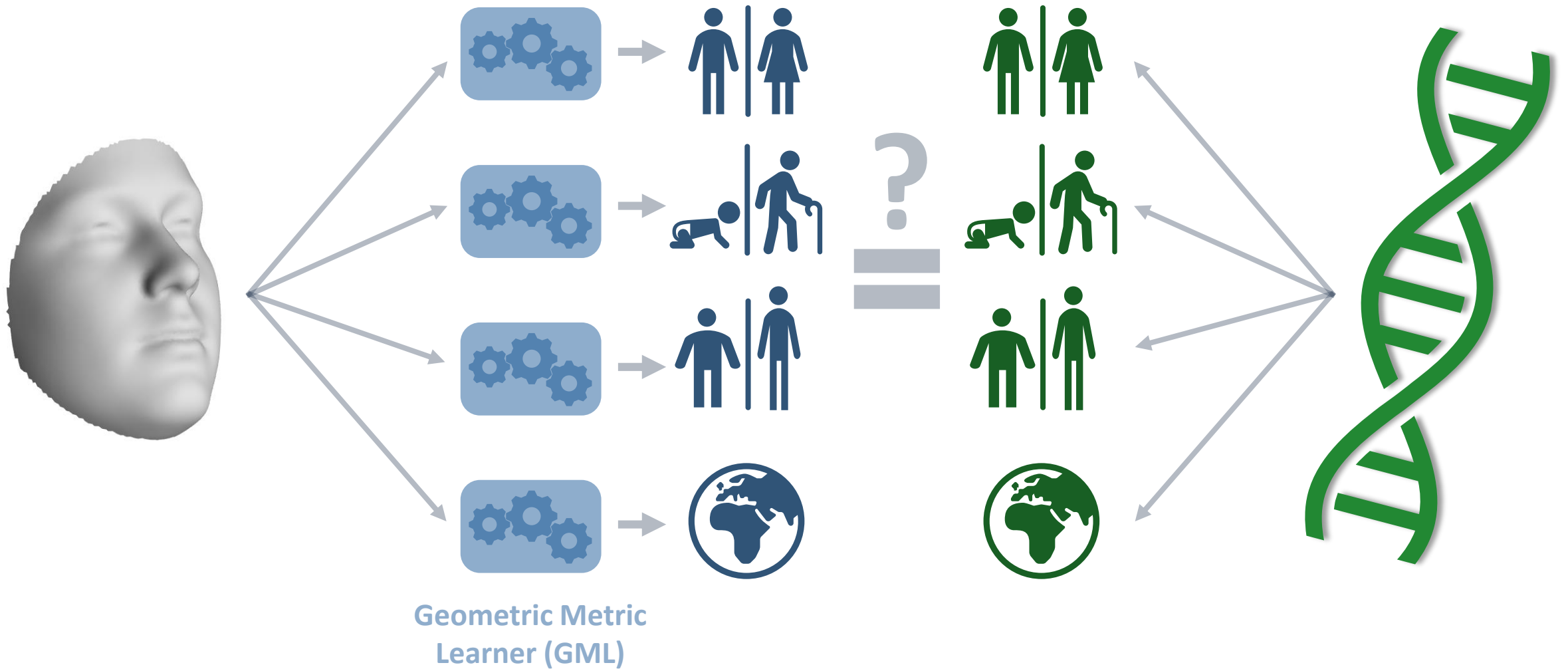
Problem Statement



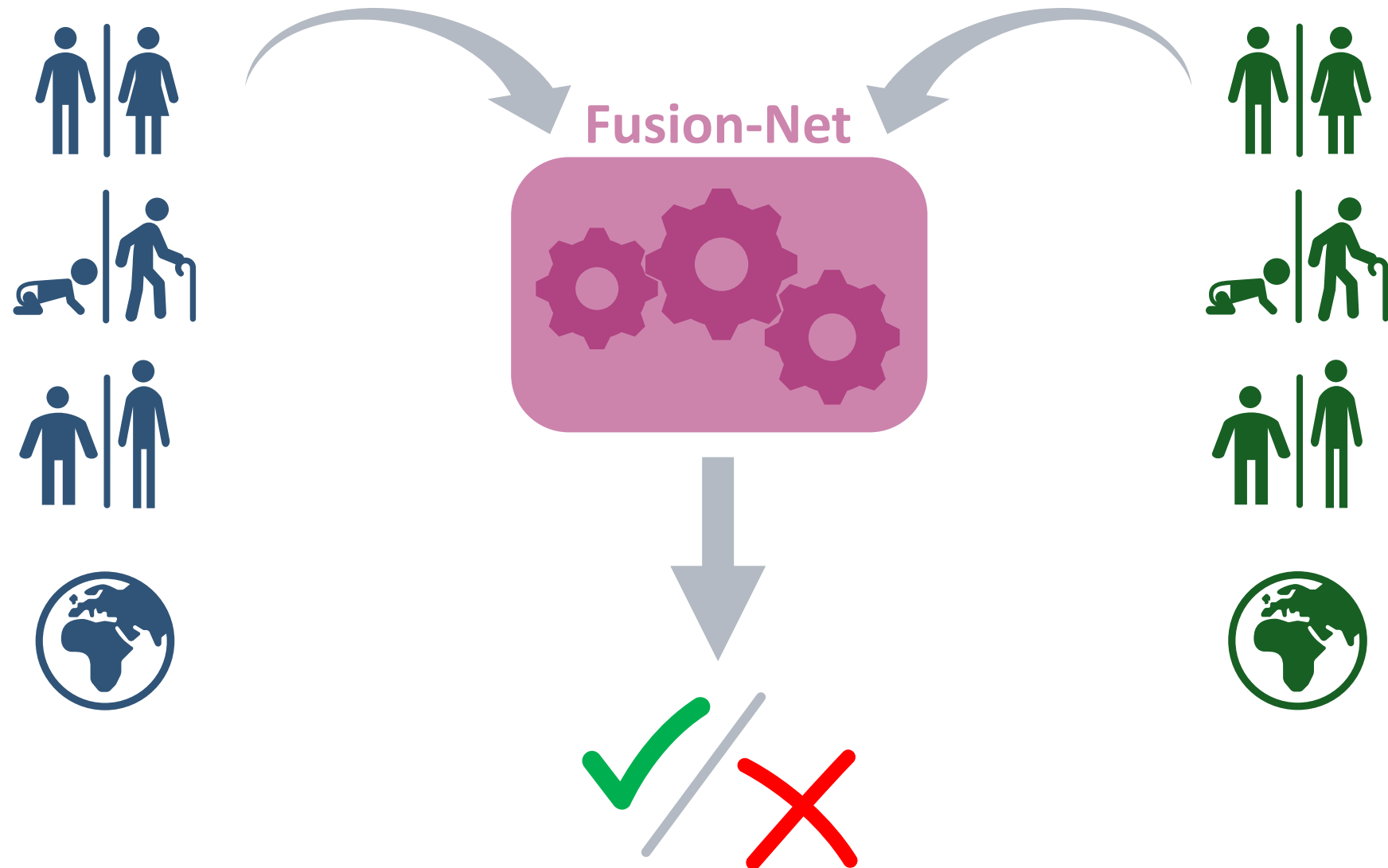
Problem Statement: Step 1



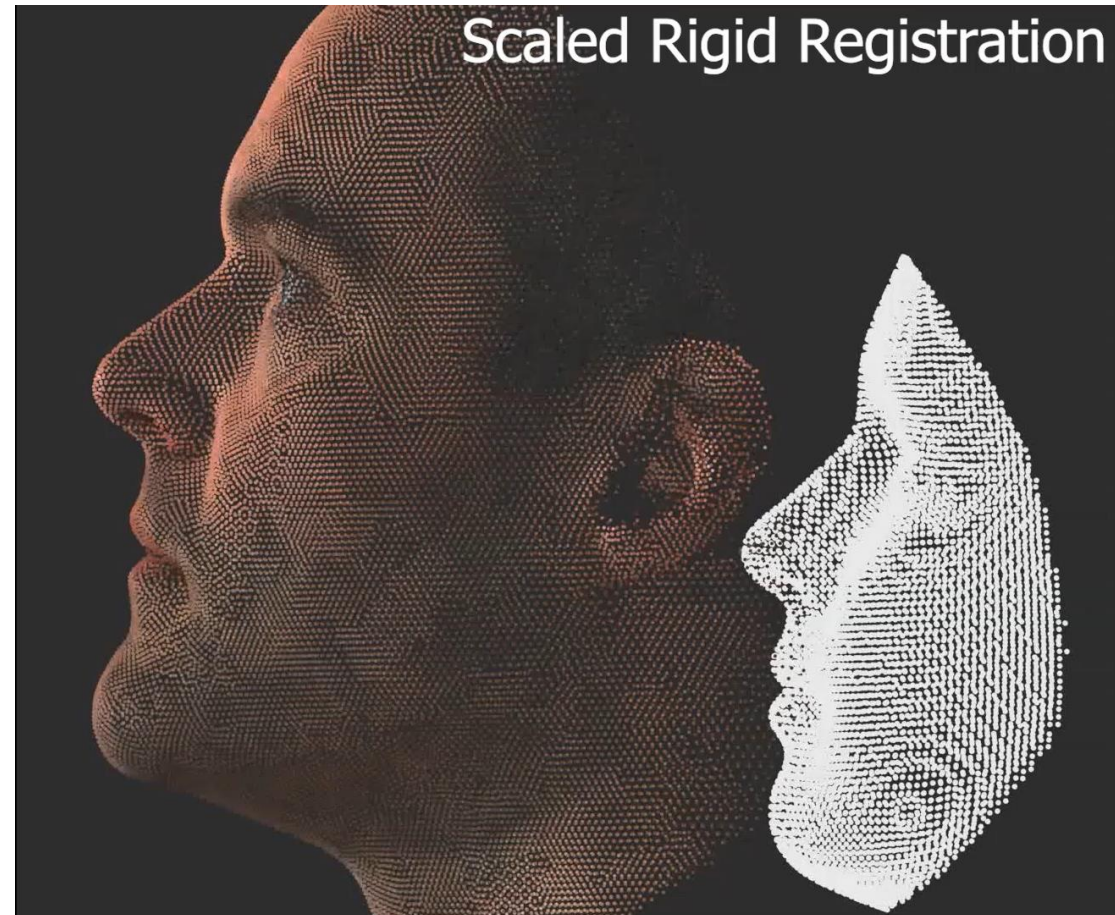
Problem Statement: Step 1



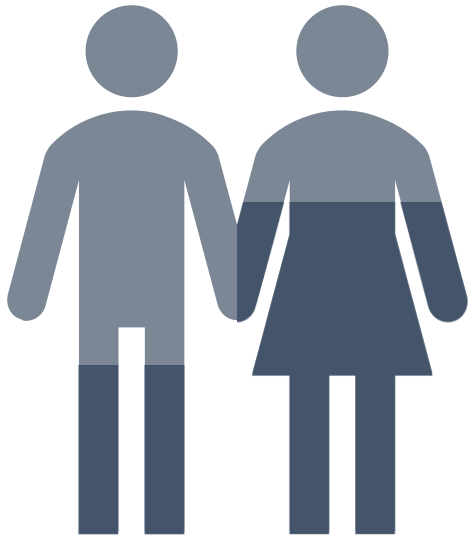
Problem Statement: Step 2



Data

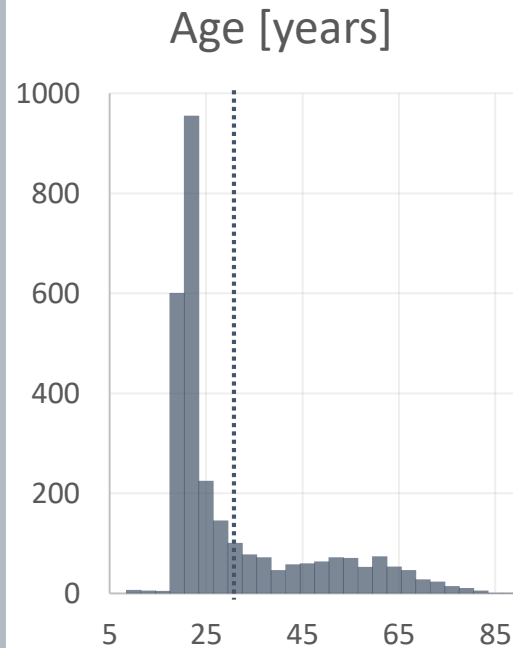


2,145 individuals



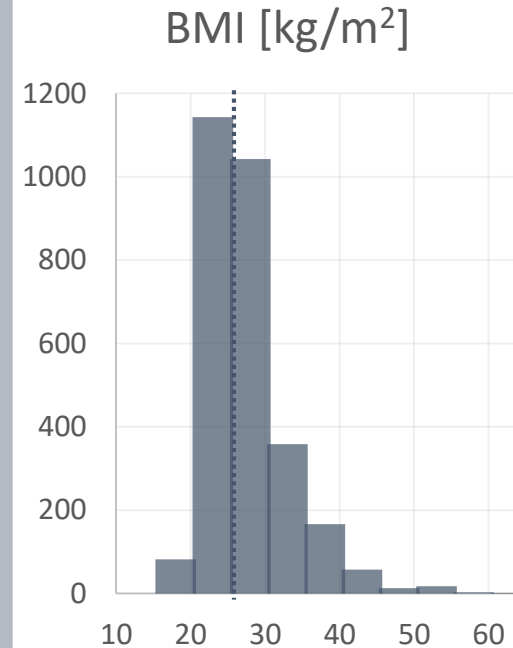
SEX

68% female,
32% male



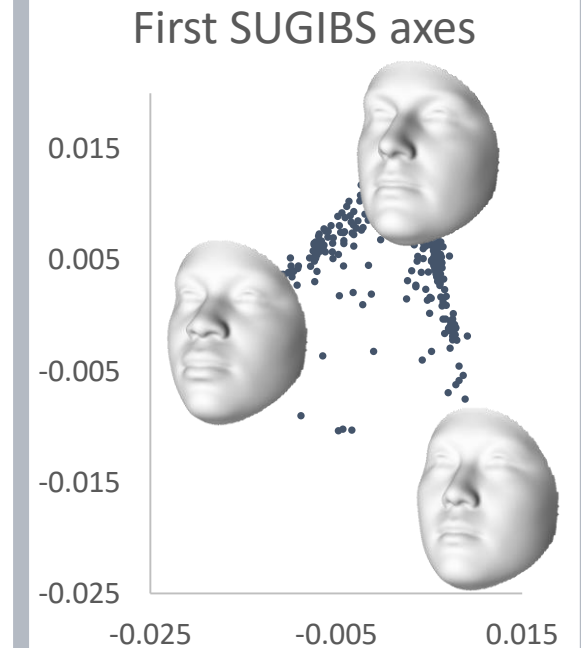
AGE

[5 - 80]
 $\bar{x} = 27, \tilde{x} = 21$



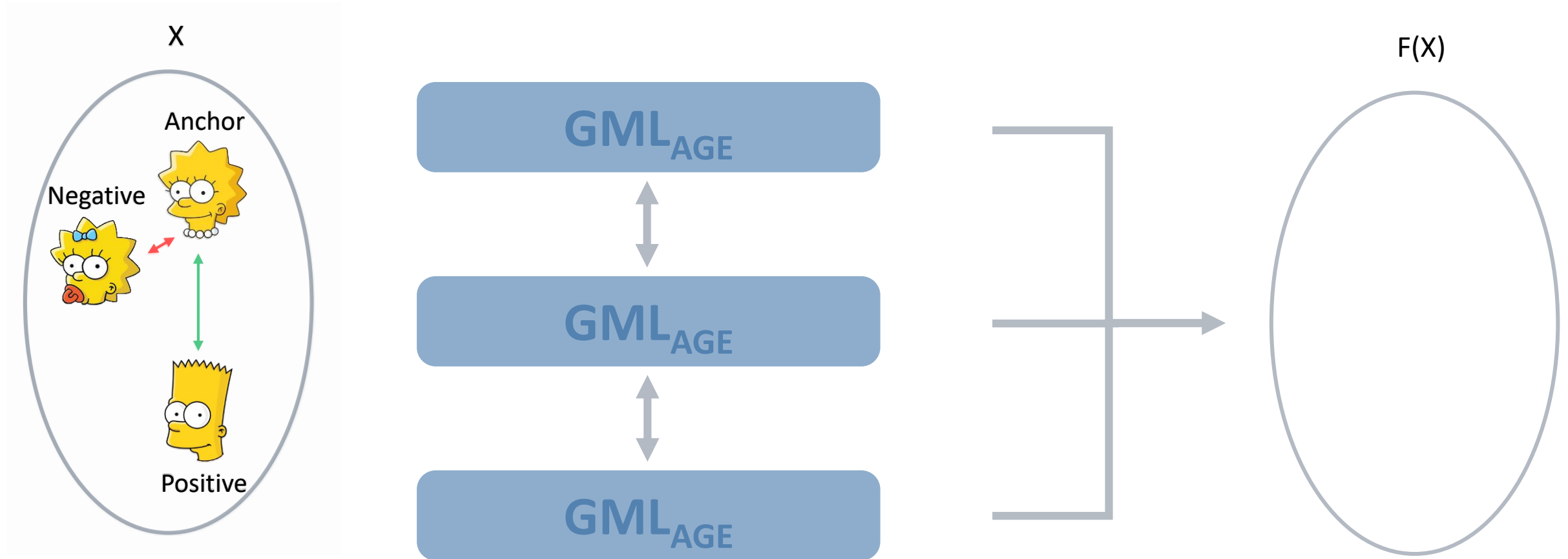
BMI

[11.87 - 62.11]
 $\bar{x} = 25.03, \tilde{x} = 23.74$



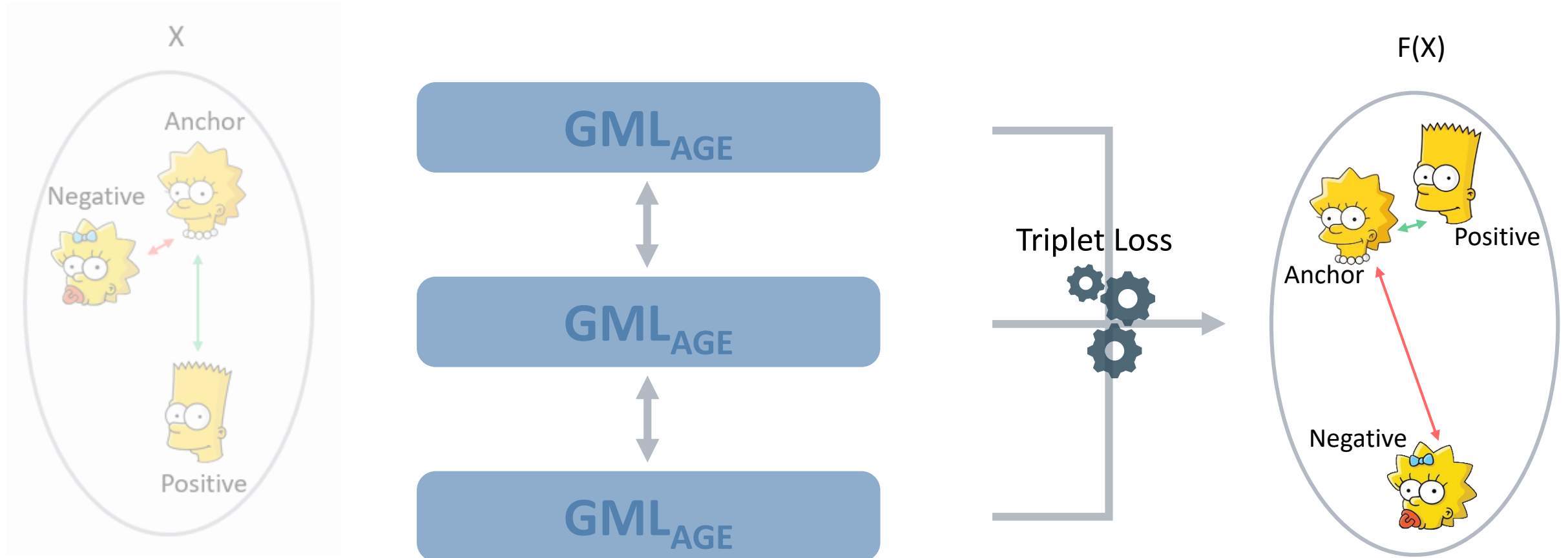
25 SUGIBS scores [1]

Step 1: Metric Learning – Triplet loss



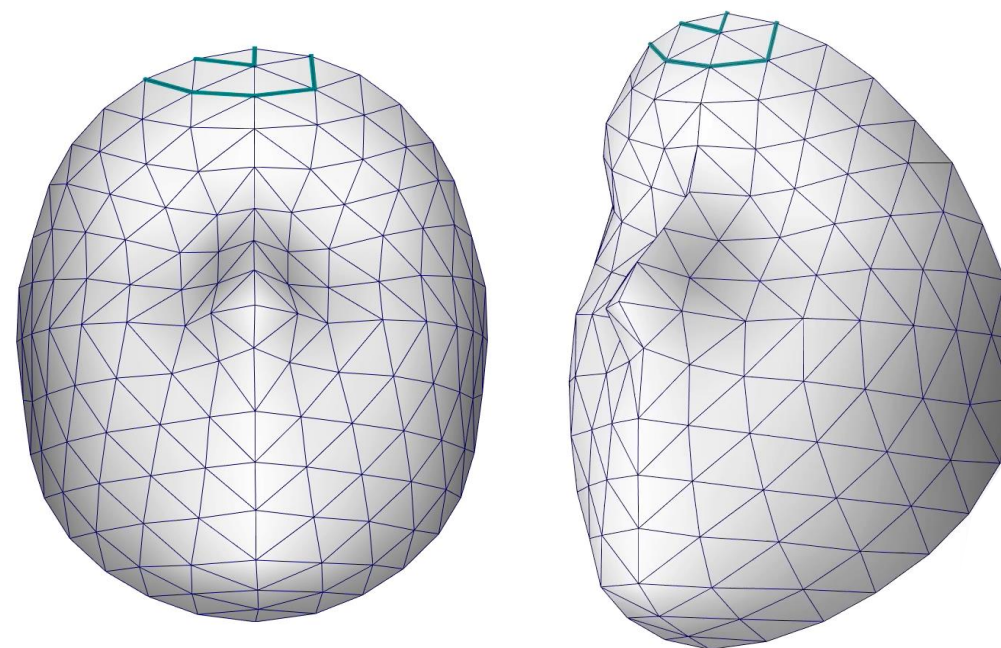
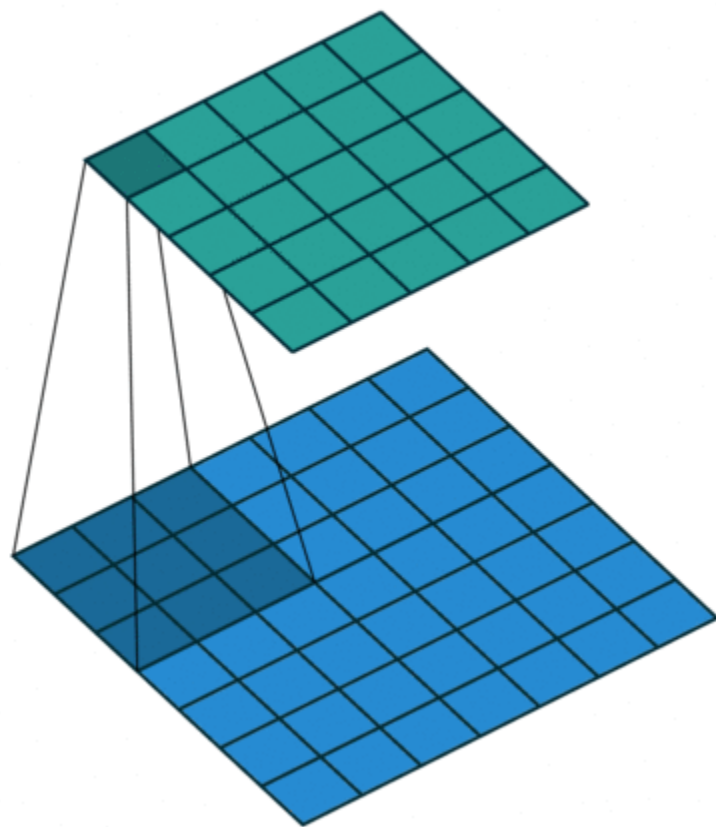
$$TripletLoss = \max(\|f(A) - f(P)\|_2^2 - \|f(A) - f(N)\|_2^2 + \alpha, 0)$$

Step 1: Metric Learning – Triplet loss

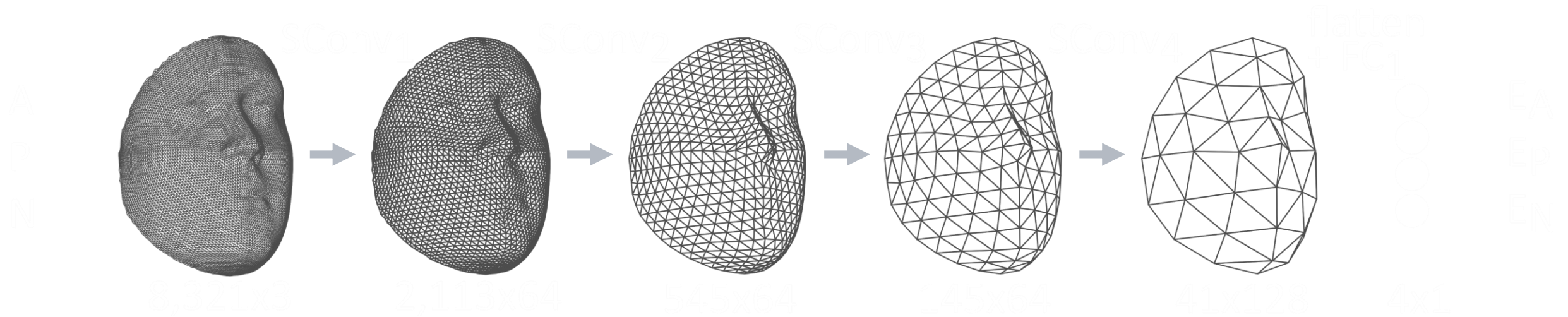


$$TripletLoss = \max(\|f(A) - f(P)\|_2^2 - \|f(A) - f(N)\|_2^2 + \alpha, 0)$$

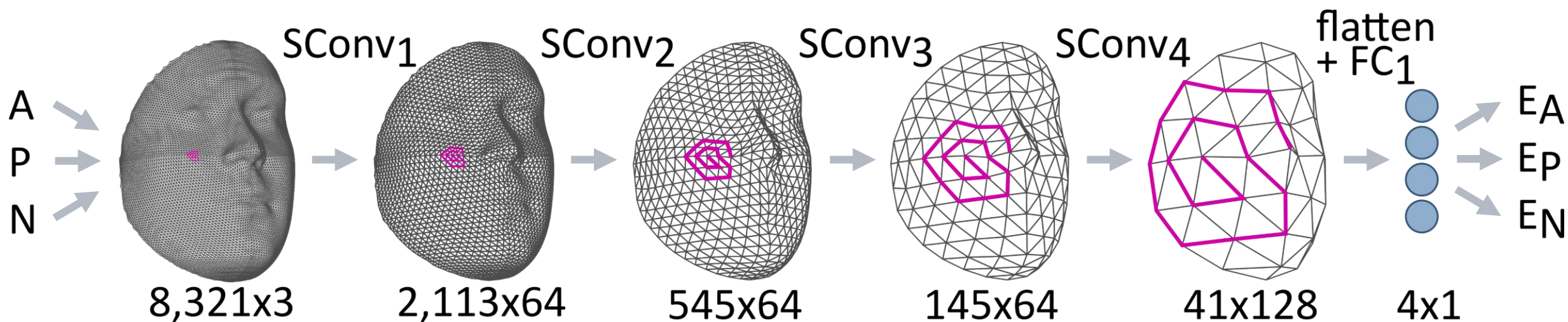
Step 1: Spiral convolutions



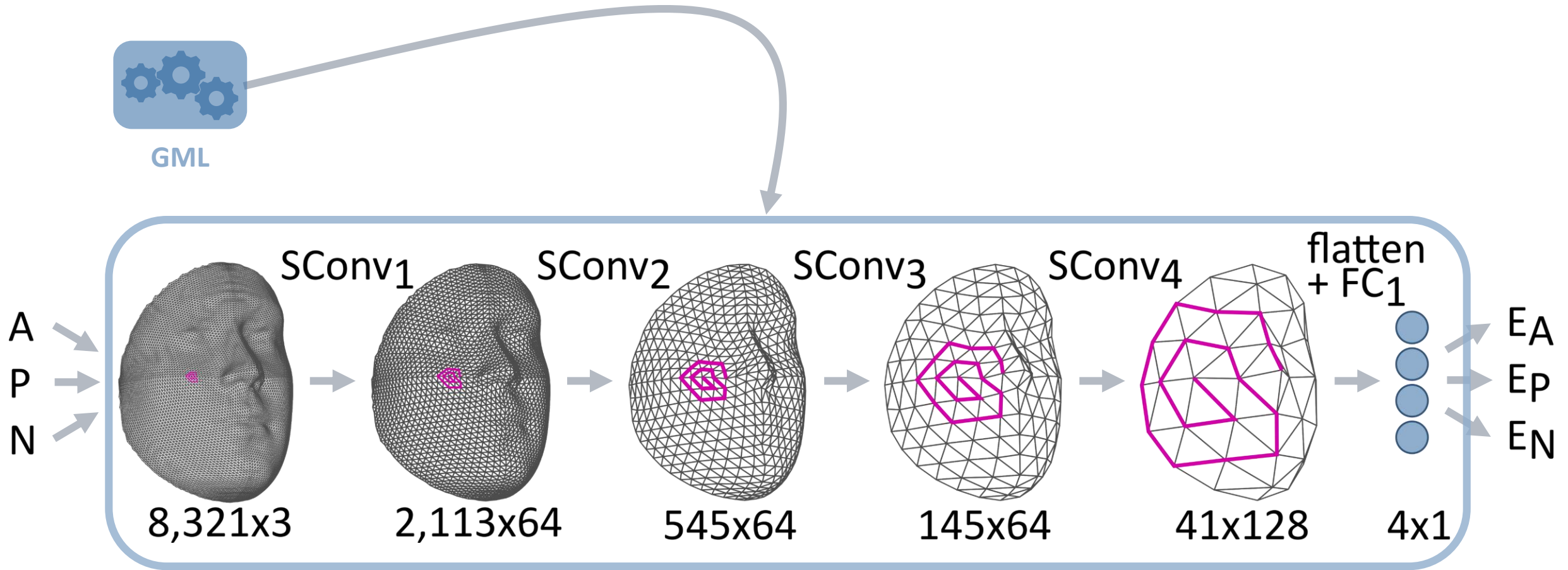
Step 1: Mesh sampling



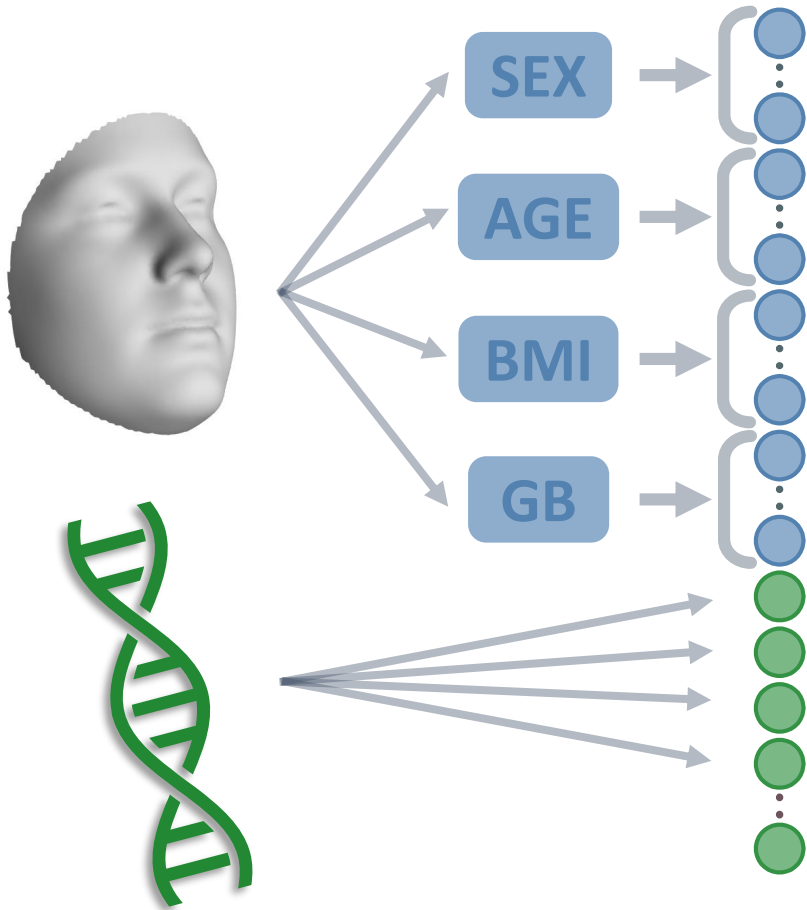
Step 1: Geometric Metric Learner



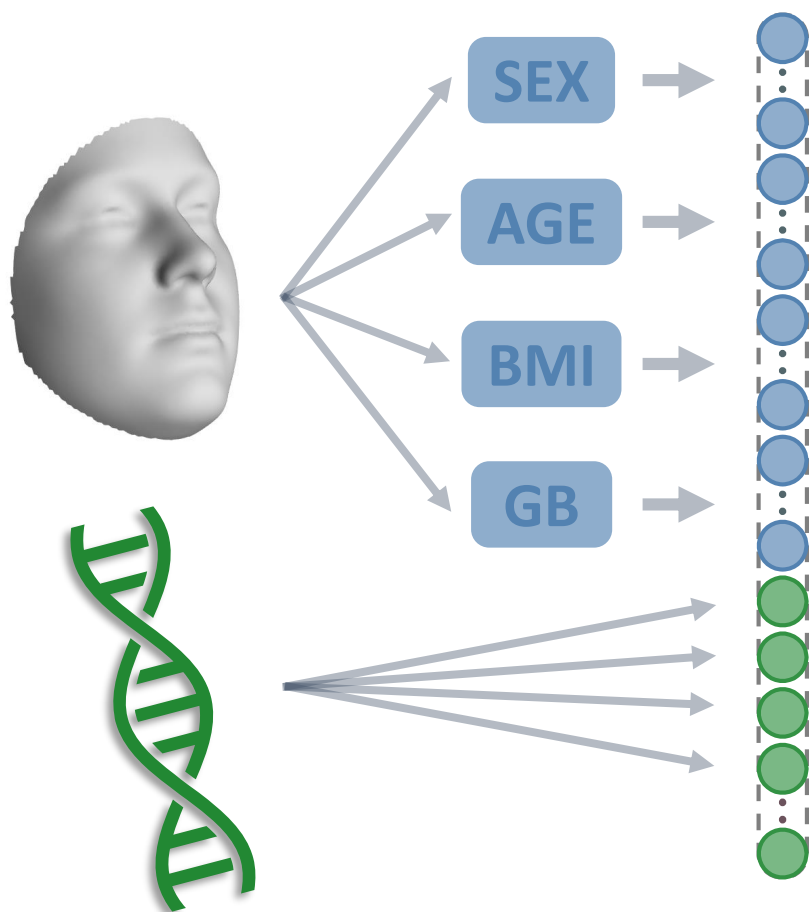
Step 1: Geometric Metric Learner



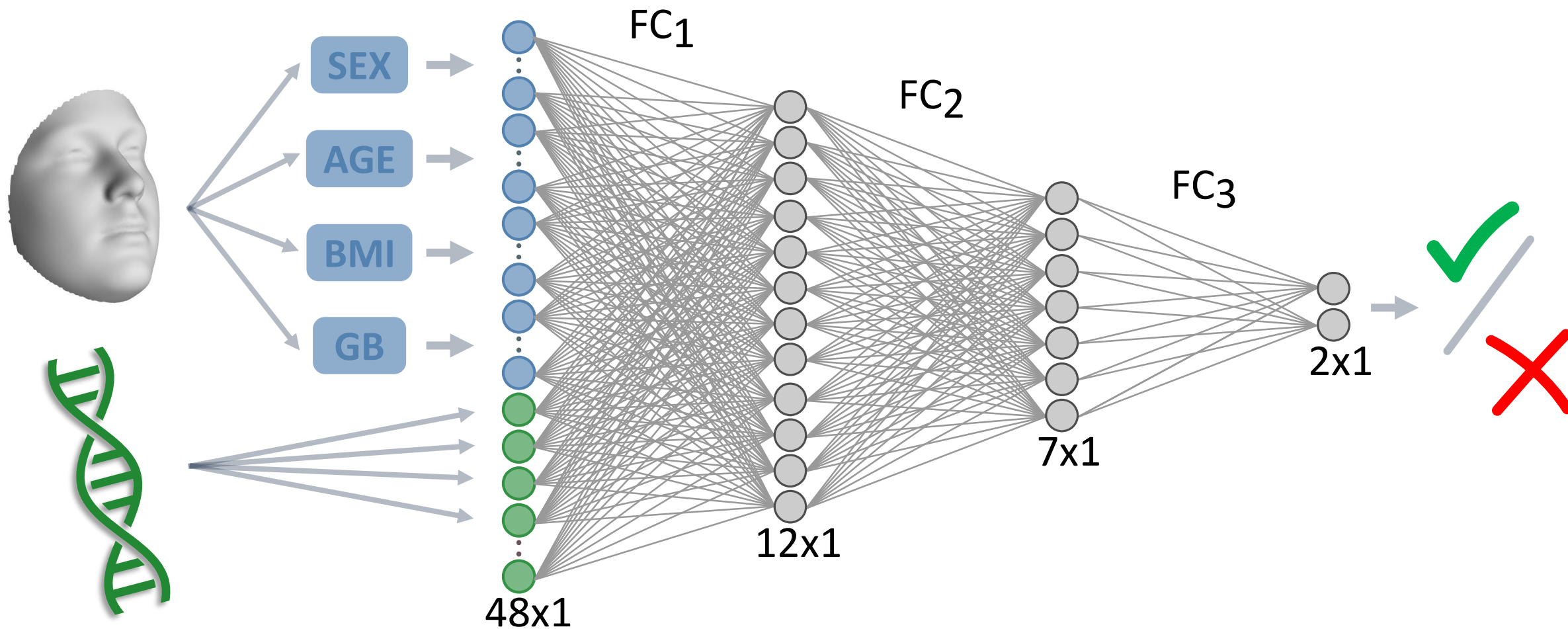
Step 2: Fusion-Net



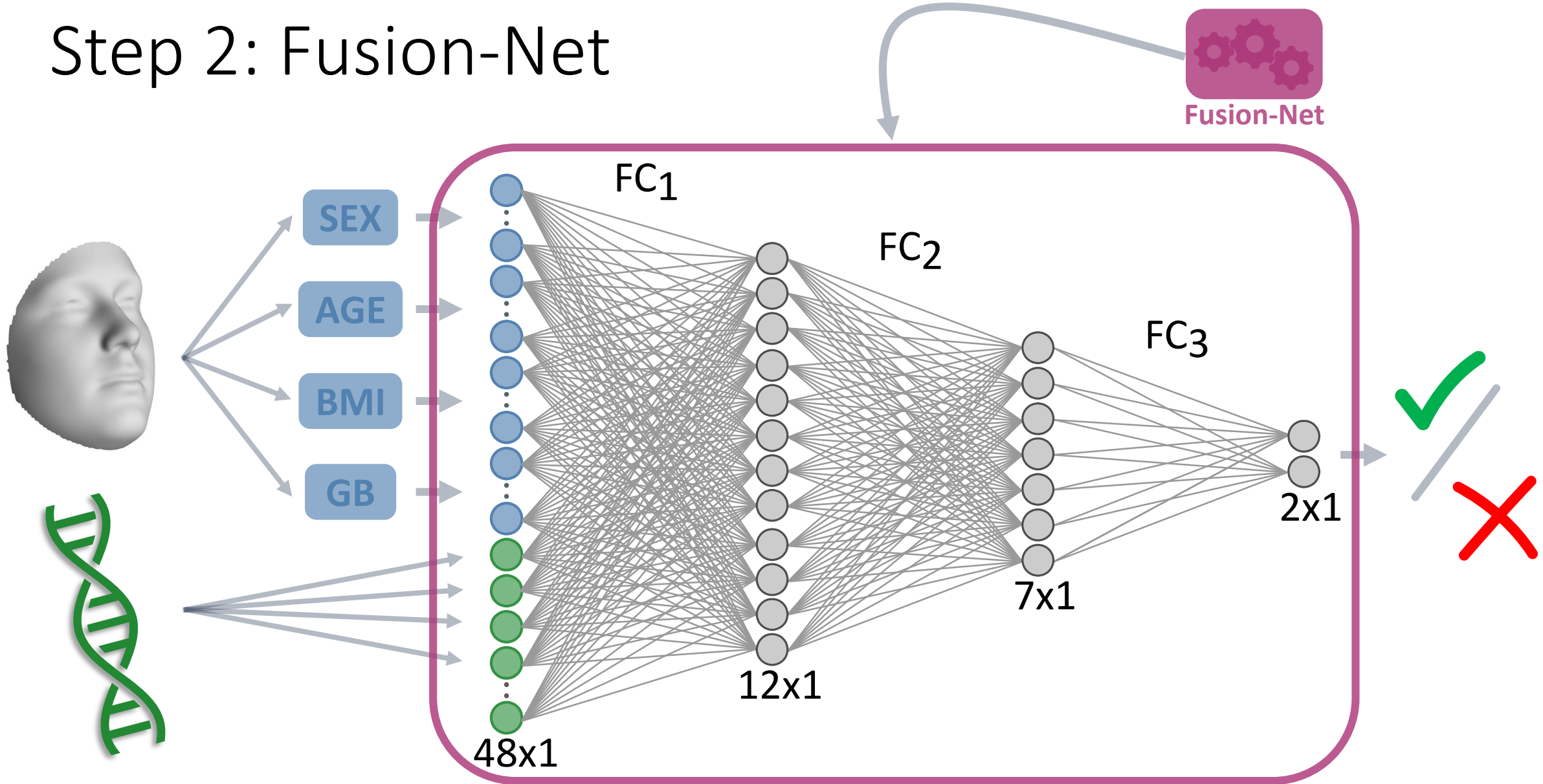
Step 2: Fusion-Net



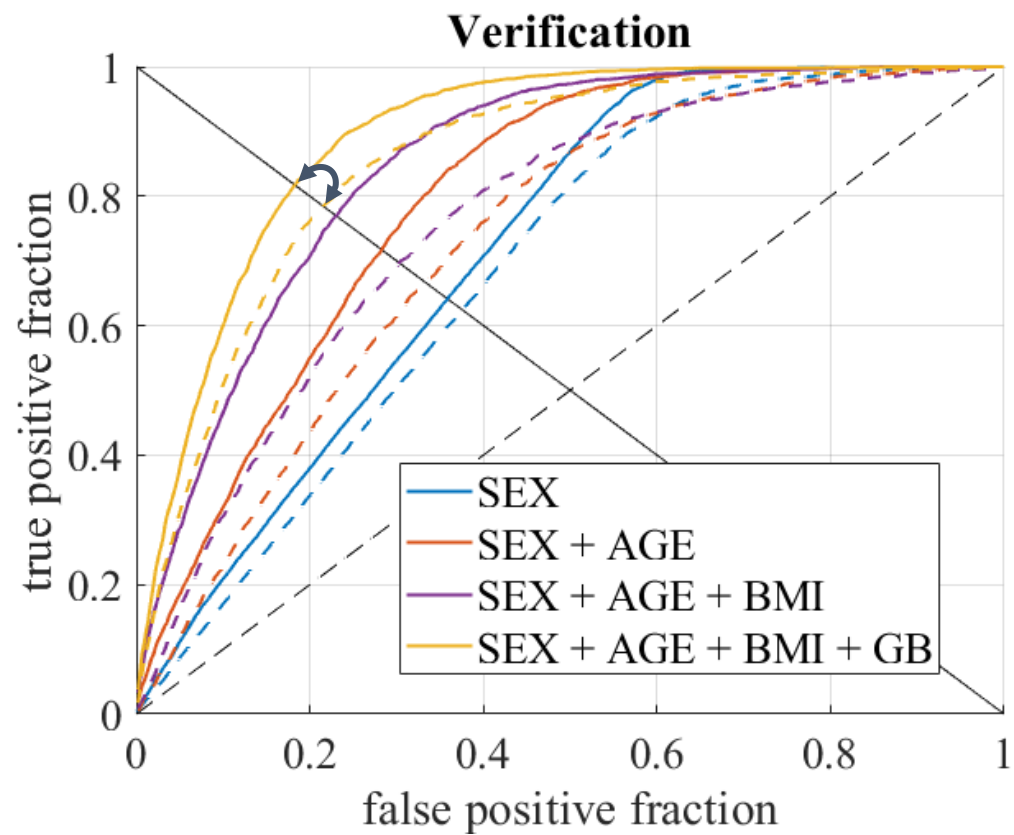
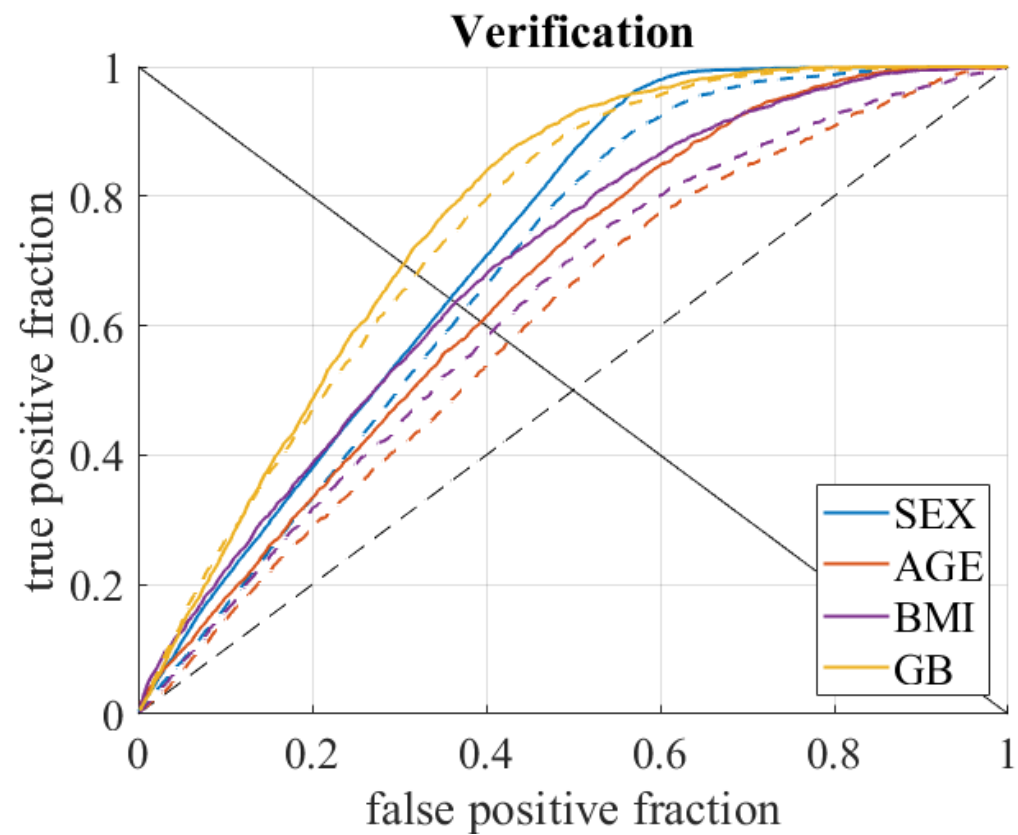
Step 2: Fusion-Net



Step 2: Fusion-Net



Results



---: Principal component analysis + support vector machines + Naïve Bayes score fuser
—: Geometric Metric Learner + Fusion-Net



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