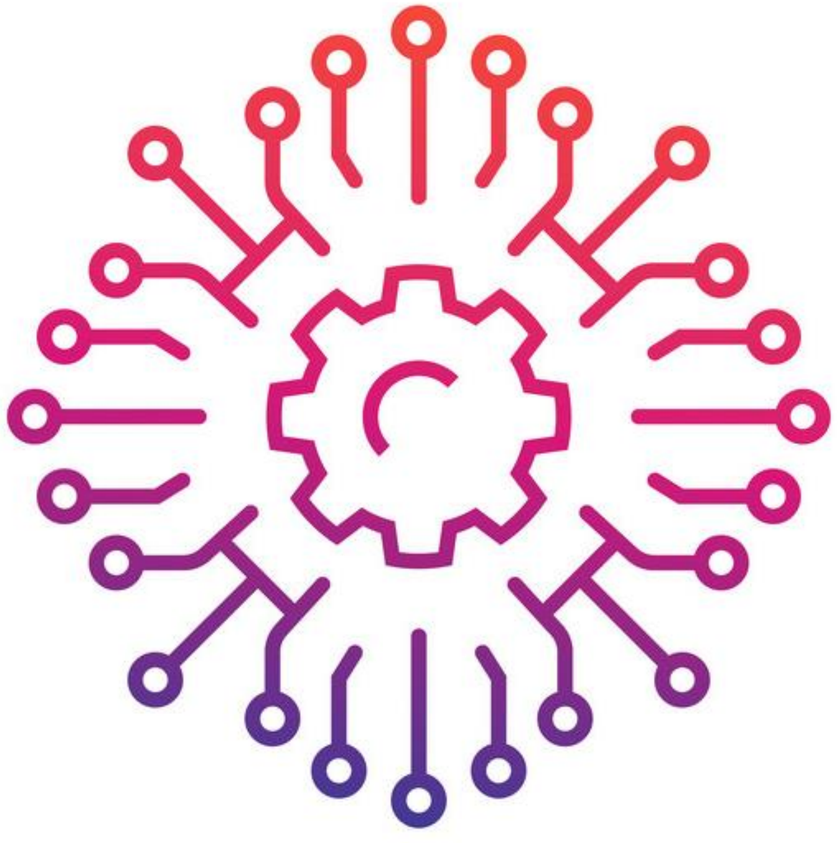
# Responsible AI: Looking into the Learned Feature Spaces



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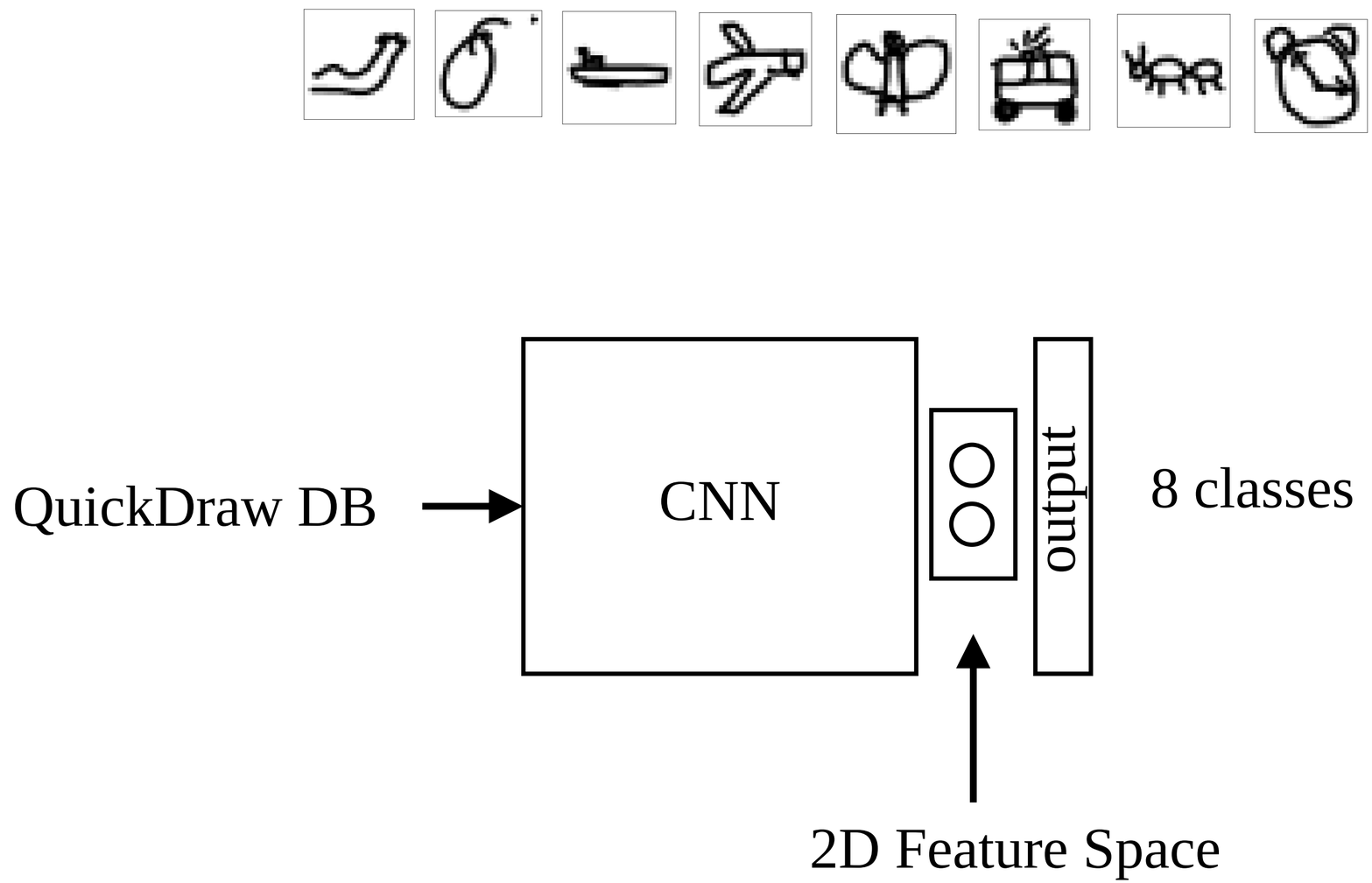
Biometrics & Data Pattern Analytics Lab

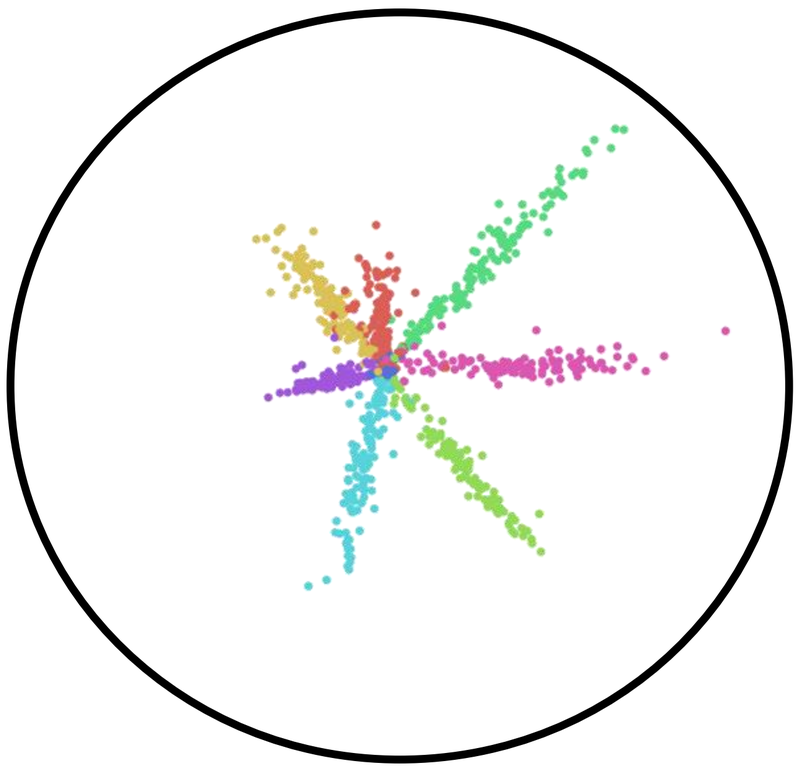
UAM
Universidad Autónoma de Madrid

# Toy Example


Quick Draw DB
QuickDraw DB
CNN
output
8 classes
2D Feature Space

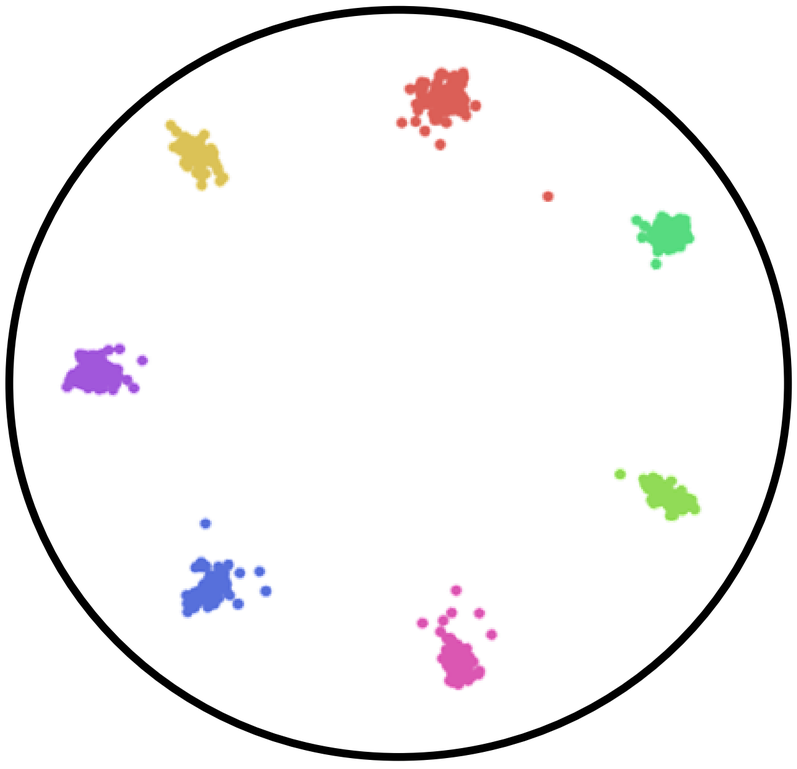
# Toy Example

Softmax



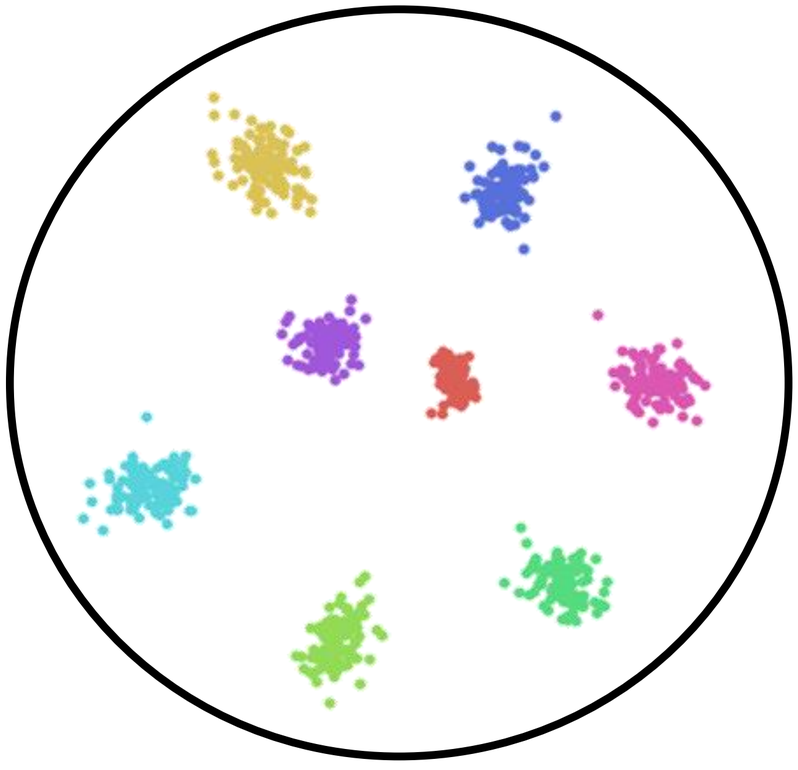
2D Feature Space

Center Loss



2D Feature Space

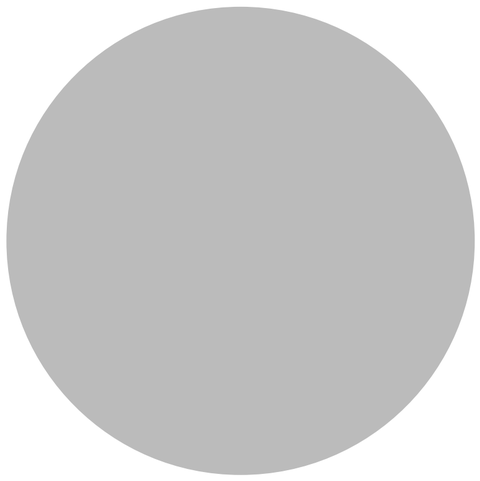
Triplet Loss



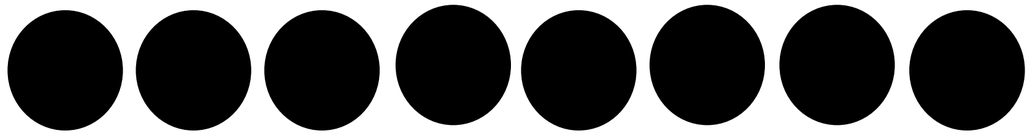
2D Feature Space

# Circle Packaging

$N = 8$



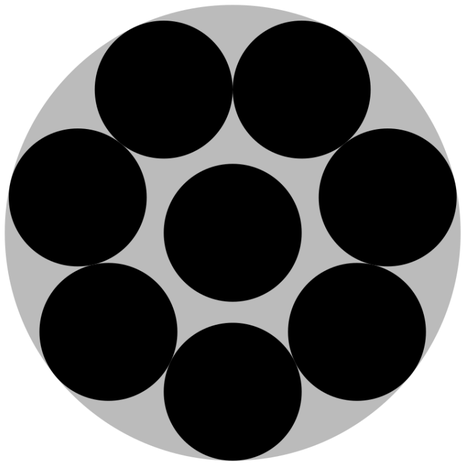
2D Feature Space



Classes

# Circle Packaging

$N = 8$

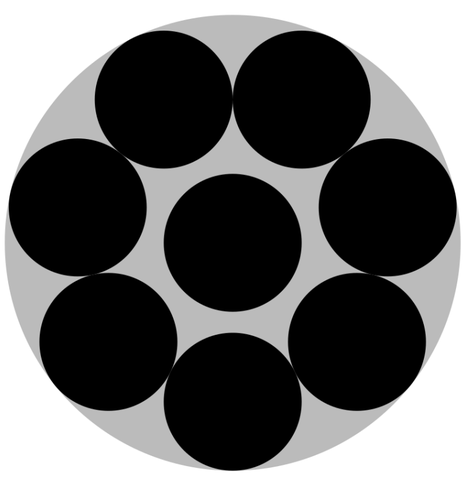


Proved optimal by Pirl (1969)

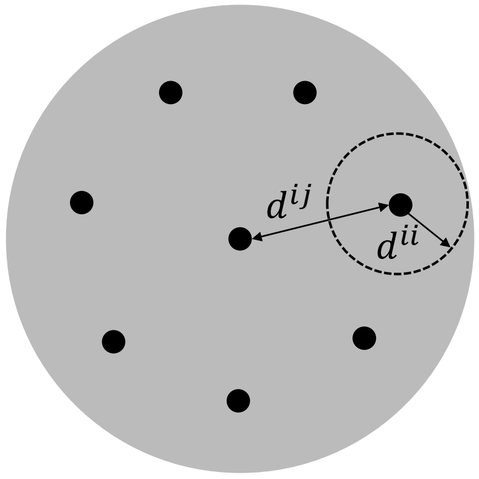
U. Pirl, *Der Mindestabstand von n in der Einheitskreisscheibe gelegenen Punkten*, *Mathematische Nachrichten* 40 (1969) 111-124.

# Circle Packaging

$N = 8$



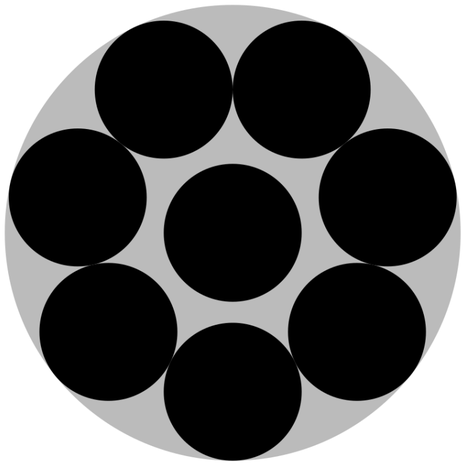
Proved optimal by Pirl (1969)




U. Pirl, *Der Mindestabstand von n in der Einheitskreisscheibe gelegenen Punkten*, Mathematische Nachrichten 40 (1969) 111-124.

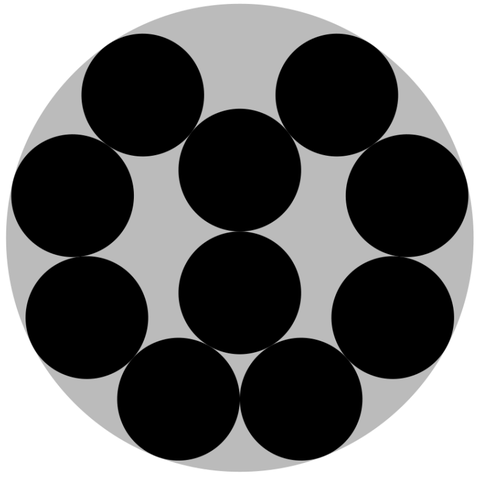
# Circle Packaging

$N = 8$



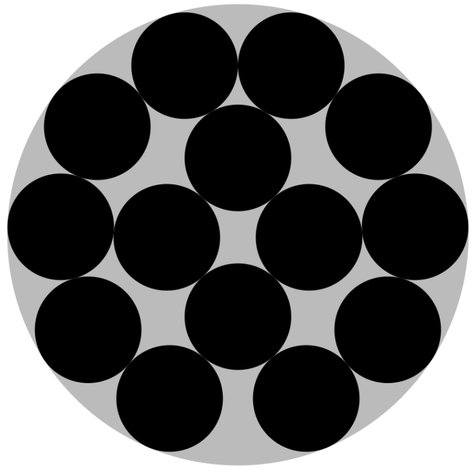
Proved optimal by Pirl (1969)

$N = 10$



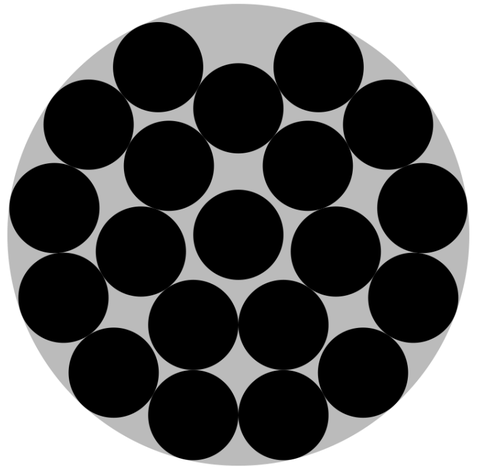
Proved optimal by Pirl (1969)

$N = 14$



Conjectured optimal (1998)

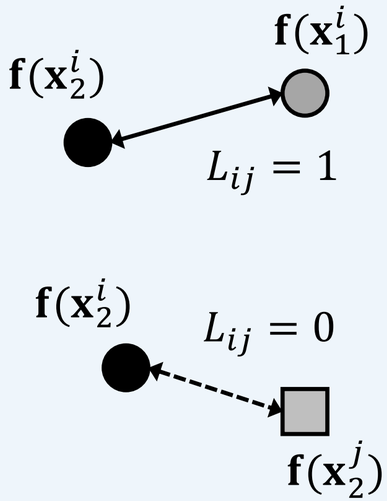
$N = 20$



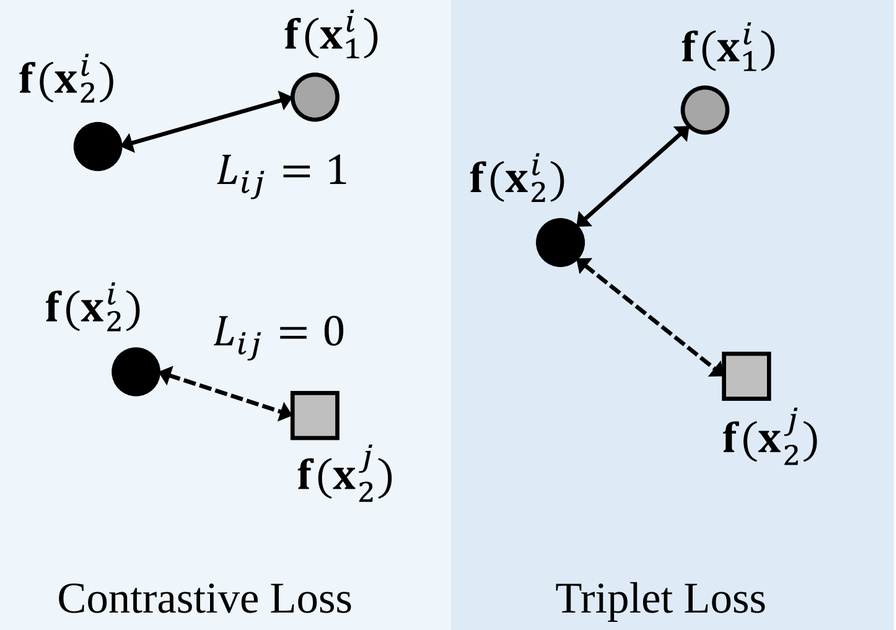
Conjectured optimal (1998)


U. Pirl, *Der Mindestabstand von n in der Einheitskreisscheibe gelegenen Punkten*, *Mathematische Nachrichten* 40 (1969) 111-124.

Graham RL, Lubachevsky BD, Nurmela KJ, Ostergard PRJ. Dense packings of congruent circles in a circle. *Discrete Math* 1998;181:139–154.



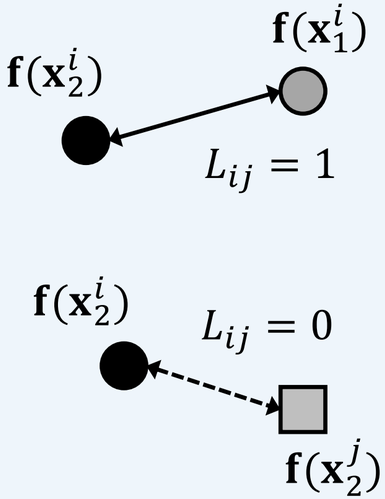

Contrastive Loss [ref]



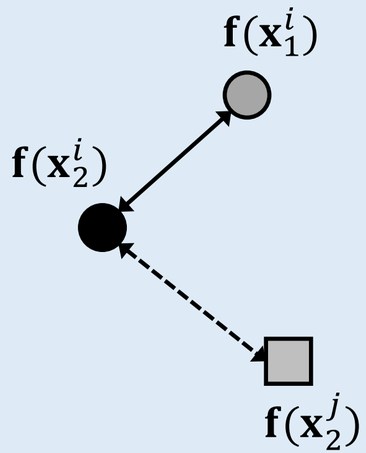

Contrastive Loss



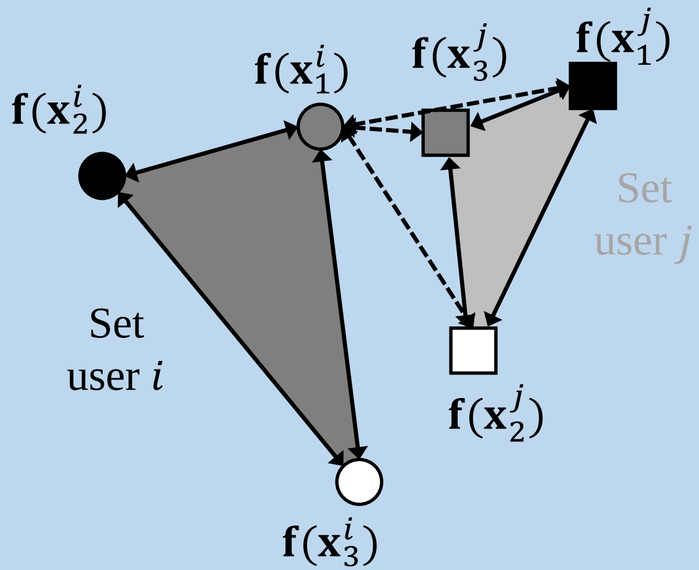

Triplet Loss



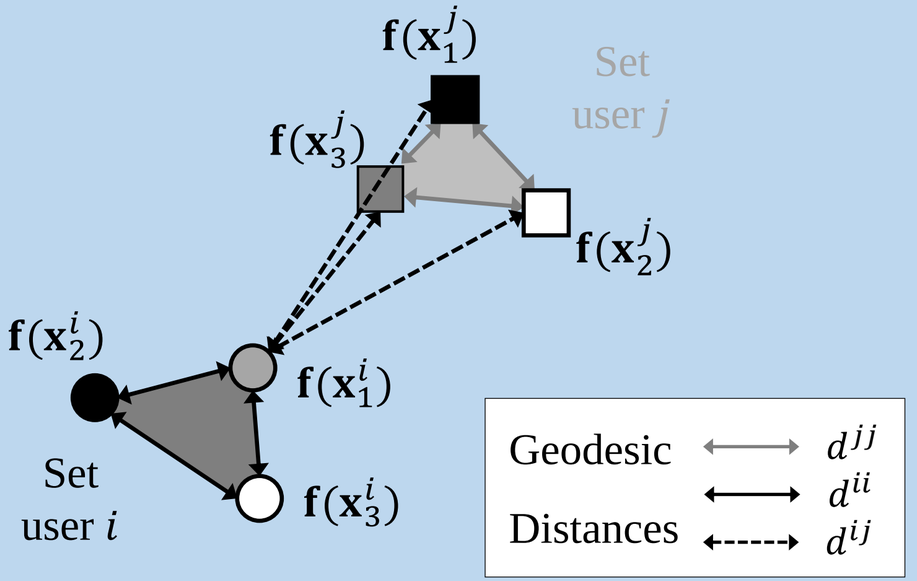

Contrastive Loss



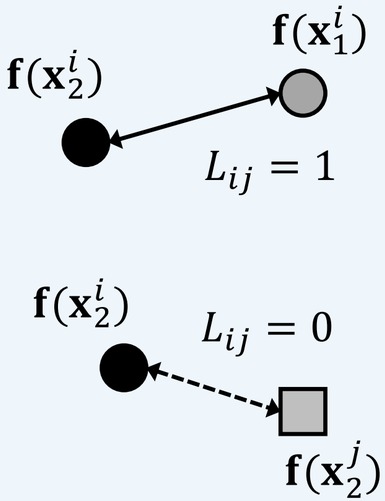

Triplet Loss



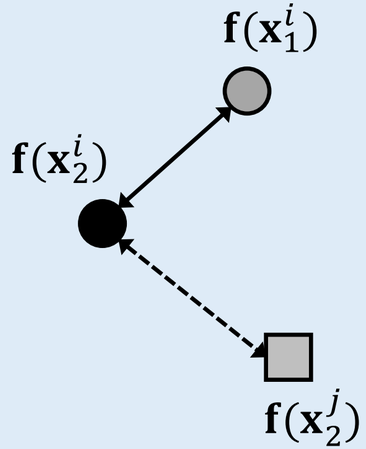

Aggregate Loss (Before Training)



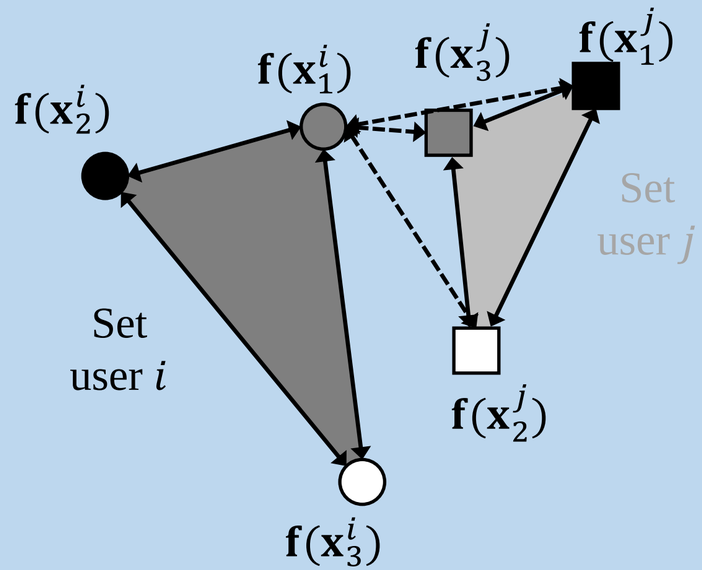

Aggregate Loss (After Training)



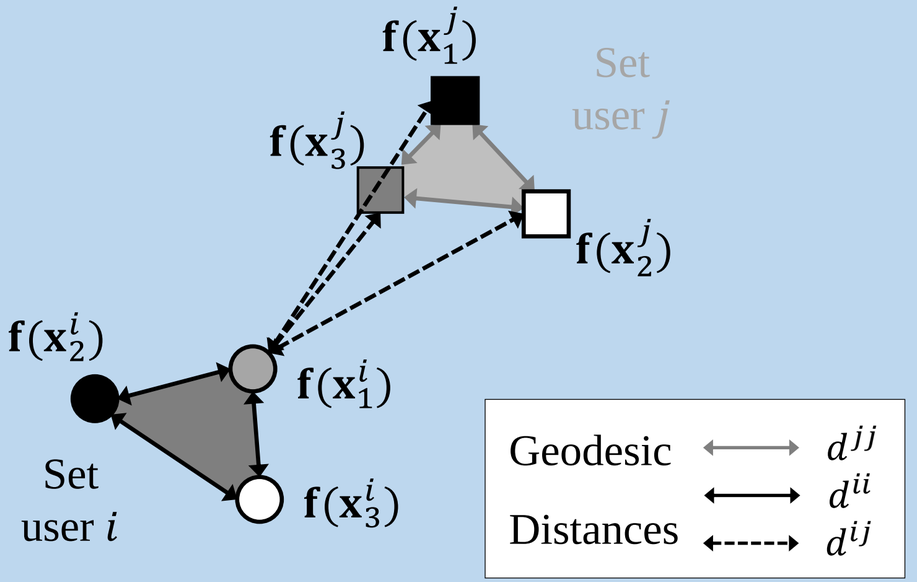

Contrastive Loss




Triplet Loss

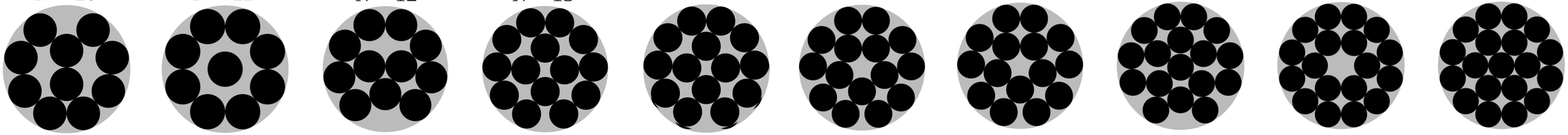


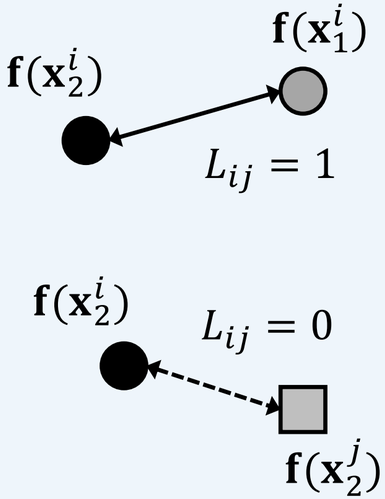

Aggregate Loss (Before Training)



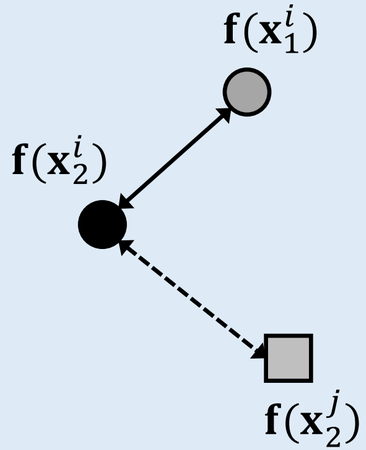

Aggregate Loss (After Training)

C. Packing

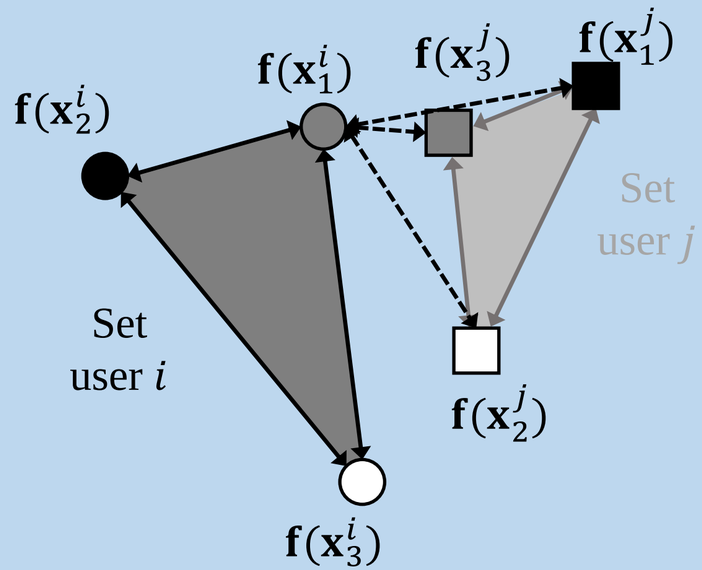




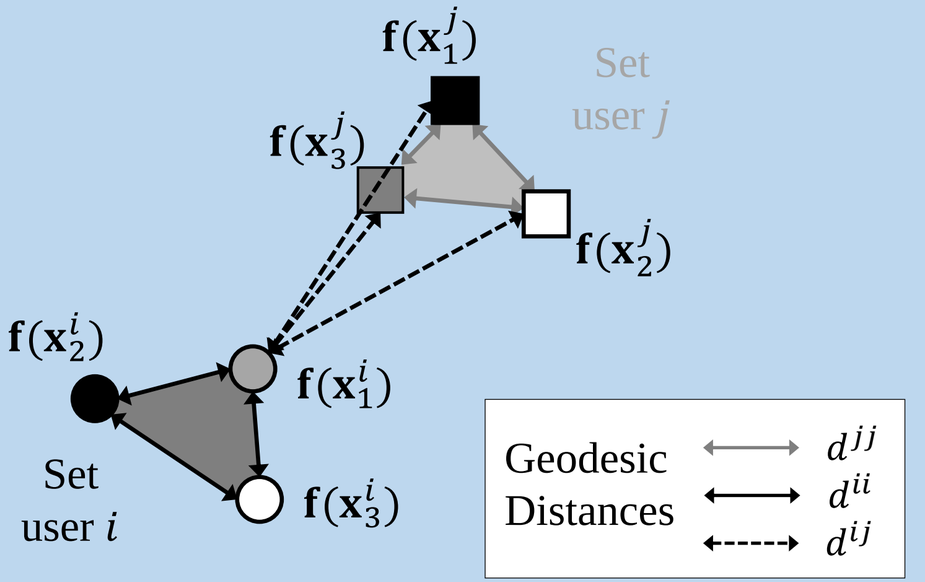

Contrastive Loss



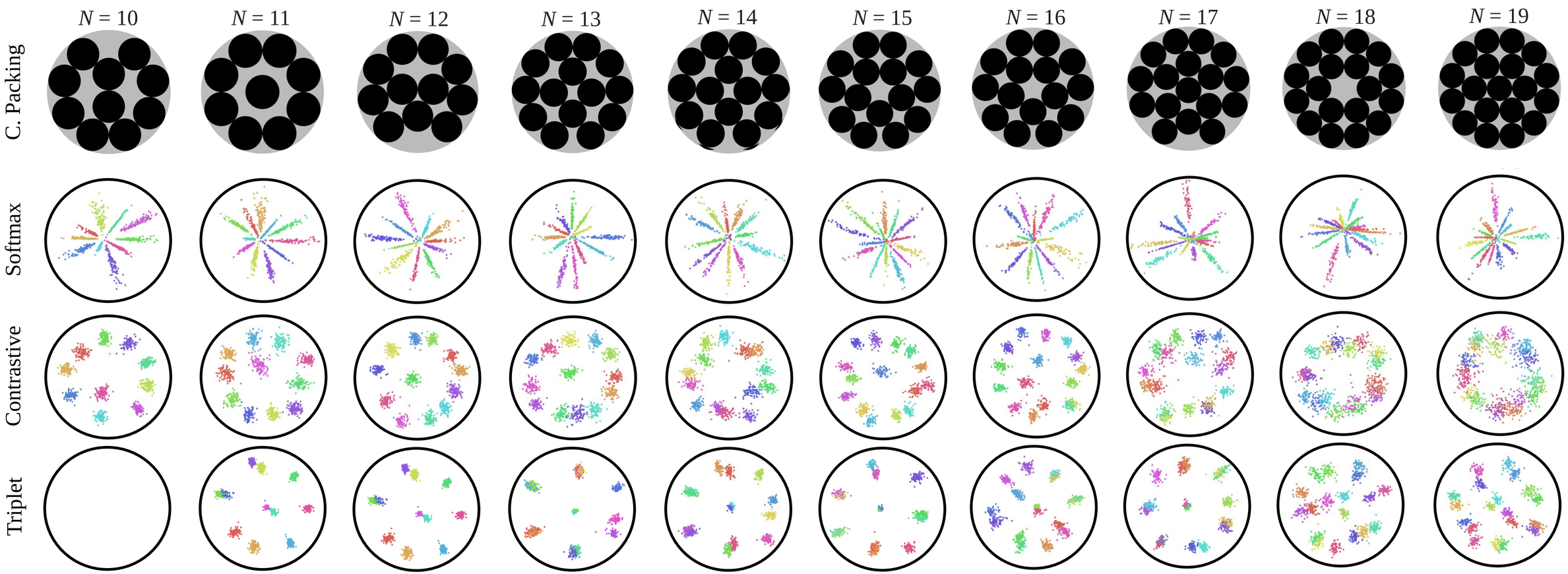

Triplet Loss

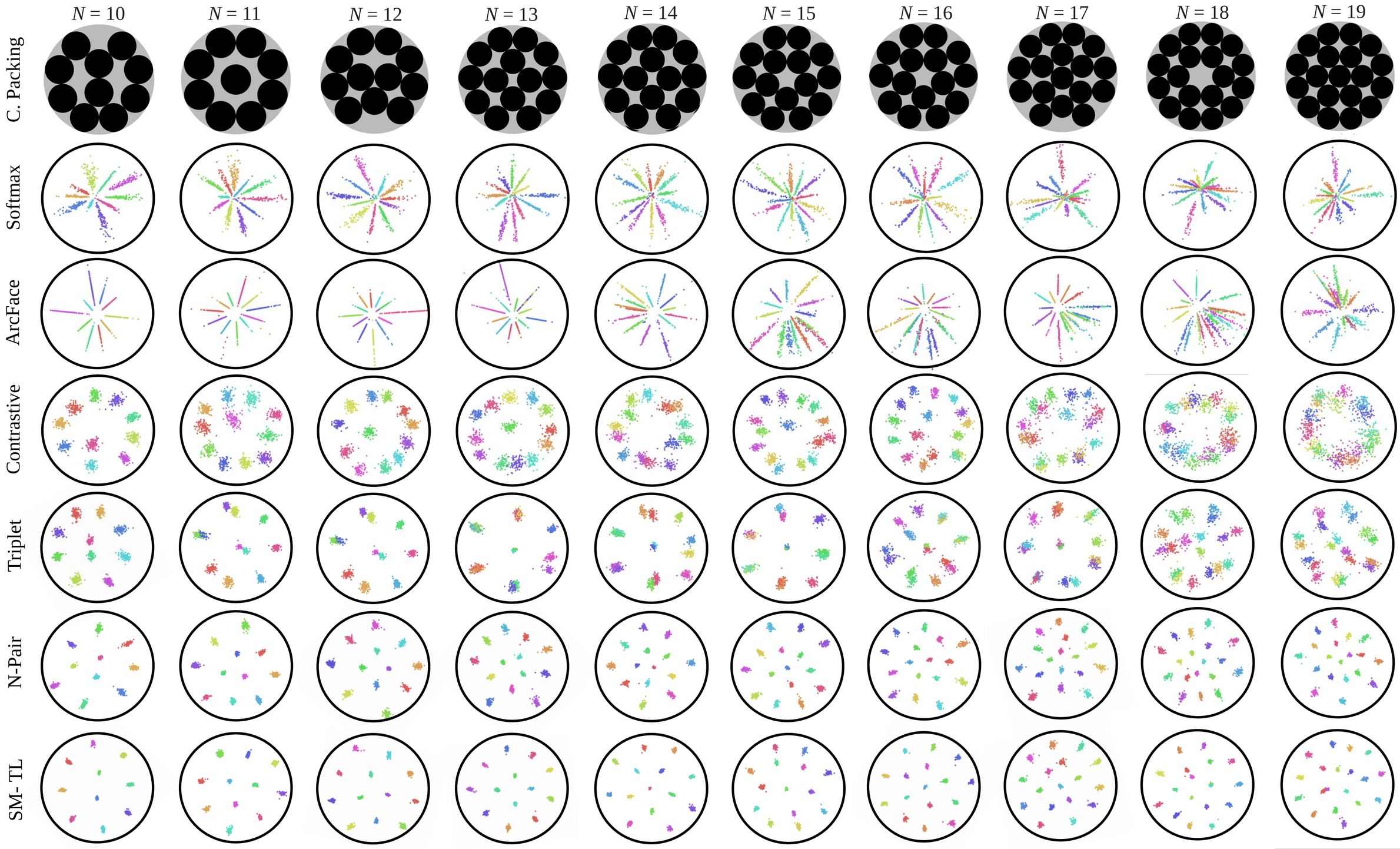



Aggregate Loss (Before Training)




Aggregate Loss (After Training)




N = 10
N = 11
N = 12
N = 13
N = 14
N = 15
N = 16
N = 17
N = 18
N = 19
C. Packing
Softmax
ArcFace
Contrastive
Triplet
N-Pair
SM- TL