# read\_codex args

codex\_blanks="../Data/raw\_dataset/codex\_blanks.csv",

codex\_protein="../Data/`raw\_dataset/codex\_protein.csv",

codex\_size="../Data/raw\_dataset/codex\_size.csv",

codex\_spatial="../Data/raw\_dataset/codex\_spatial.csv",

codex\_preprocess=True,

codex\_border=564000,

# read\_cite args

cite\_latent="../Data/raw\_dataset/cite\_latent.csv",

cite\_protein="../Data/raw\_dataset/cite\_protein.csv",

cite\_mrna="../Data/raw\_dataset/cite\_mRNA.csv",

# take\_subset args

amount\_codex=-1, # -1 = default ≈ 9000 CODEX cells

amount\_cite=-1, # -1 ≈ 7000 cells

# filter\_codex args

size\_lim=(1000, 25000),

blank\_lower=(-1200, -1200, -1200, -1200),

blank\_upper=(6000, 2500, 5000, 2500),

# clean\_cite args

maxit=500,

factr=1e-9,

optim\_init=([10, 60, 2, 0.5, 0.5],

[4.8, 50, 0.5, 2, 0.5],

A screenshot of a cell phone

Description automatically generated [2, 18, 0.5, 2, 0.5],

A screenshot of a computer

Description automatically generated [1, 3, 2, 2, 0.5],

[1, 3, 0.5, 2, 0.5]),

ignore\_warnings=True,

clean\_cite\_method="l-bfgs-b",

# cluster\_codex args

cluster\_codex\_k=10,

cluster\_codex\_knn\_option=1,

# parameter\_scan args

parameter\_scan\_min\_cluster\_size\_range=tuple(range(5, 21, 4)),

parameter\_scan\_min\_sample\_range=tuple(range(10, 41, 3)),

parameter\_scan\_n\_neighbors=50,

parameter\_scan\_min\_dist=0.1,

parameter\_scan\_negative\_sample\_rate=50,

parameter\_scan\_metric="correlation",

# consensus\_cluster args

consensus\_cluster\_silhouette\_cutoff=0.126,

consensus\_cluster\_inconsistent\_value=0.1,

consensus\_cluster\_min\_cluster\_size=10,

# map\_codex\_to\_cite args

k\_find\_nn=80,

k\_find\_anchor=20,

k\_filter\_anchor=100,

k\_score\_anchor=80,

k\_find\_weights=100,

# transfer\_matrix

k\_transfer\_matrix=None,

c\_transfer\_matrix=0.1,

mask=False

result:

Macrophages: TPR: 41.24% TNR: 98.34

B cells: TPR: 99.08% TNR: 64.44

A screenshot of a graph

Description automatically generatedNeutrophils: TPR: 71.43% TNR: 99.84

A diagram of a heatmap

Description automatically generated

def test\_overall\_evaluation(self):

# initialize variable

cn = Controller.Controller()

# this pipeline will read files

cn.pipeline(

# read\_codex args

codex\_blanks="../Data/raw\_dataset/codex\_blanks.csv",

codex\_protein="../Data/raw\_dataset/codex\_protein.csv",

codex\_size="../Data/raw\_dataset/codex\_size.csv",

codex\_spatial="../Data/raw\_dataset/codex\_spatial.csv",

codex\_preprocess=True,

codex\_border=564000,

T cells: TPR: 68.59% TNR: 99.86

Transferred majority: T cells

B cells: TPR: 98.56% TNR: 87.73

Transferred majority: B cells

Neutrophils: TPR: 61.54% TNR: 99.96

Transferred majority: Neutrophils

NK cells: TPR: 41.18% TNR: 98.33

Transferred majority: NK cells

CODEX cluster 1 transferred majority: T cells

CODEX cluster 2 transferred majority: B cells

CODEX cluster 3 transferred majority: Macrophages

CODEX cluster 4 transferred majority: B cells

CODEX cluster 5 transferred majority: Macrophages

CODEX cluster 6 transferred majority: B cells

CODEX cluster 7 transferred majority: B cells

CODEX cluster 8 transferred majority: Neutrophils

CODEX cluster 9 transferred majority: B cells

CODEX cluster 10 transferred majority: NK cells

CODEX cluster 11 transferred majority: B cells

CODEX cluster 12 transferred majority:

CODEX cluster 13 transferred majority: B cells

CODEX cluster 14 transferred majority: Plasma cells

CODEX cluster 15 transferred majority: B cells

CODEX cluster 16 transferred majority: T cells

CODEX cluster 17 transferred majority: T cells

CODEX cluster 18 transferred majority: B cells

CODEX cluster 19 transferred majority: B cells

CODEX cluster 20 transferred majority: B cells

CODEX cluster 21 transferred majority: B cells

CODEX cluster 22 transferred majority: B cells

# read\_cite args

cite\_latent="../Data/raw\_dataset/cite\_latent.csv",

cite\_protein="../Data/raw\_dataset/cite\_protein.csv",

cite\_mrna="../Data/raw\_dataset/cite\_mRNA.csv",

# take\_subset args

amount\_codex=-1, # -1 = default ≈ 9000 CODEX cells

amount\_cite=-1, # -1 ≈ 7000 cells

# filter\_codex args

size\_lim=(1000, 25000),

blank\_lower=(-1200, -1200, -1200, -1200),

blank\_upper=(6000, 2500, 5000, 2500),

# clean\_cite args

maxit=500,

factr=1e-9,

optim\_init=([10, 60, 2, 0.5, 0.5],

[4.8, 50, 0.5, 2, 0.5],

[2, 18, 0.5, 2, 0.5],

[1, 3, 2, 2, 0.5],

[1, 3, 0.5, 2, 0.5]),

ignore\_warnings=True,

clean\_cite\_method="l-bfgs-b",

# cluster\_codex args

cluster\_codex\_k=5,

cluster\_codex\_knn\_option=1,

# parameter\_scan args

parameter\_scan\_min\_cluster\_size\_range=tuple(range(5, 21, 4)),

parameter\_scan\_min\_sample\_range=tuple(range(10, 41, 3)),

parameter\_scan\_n\_neighbors=50,

parameter\_scan\_min\_dist=0.1,

parameter\_scan\_negative\_sample\_rate=50,

parameter\_scan\_metric="correlation",

# consensus\_cluster args

consensus\_cluster\_silhouette\_cutoff=0.126,

consensus\_cluster\_inconsistent\_value=0.1,

consensus\_cluster\_min\_cluster\_size=10,

# map\_codex\_to\_cite args

k\_find\_nn=80,

k\_find\_anchor=20,

k\_filter\_anchor=100,

k\_score\_anchor=80,

k\_find\_weights=100,

# transfer\_matrix

k\_transfer\_matrix=None,

c\_transfer\_matrix=0.1,

mask=False

A screenshot of a graph

Description automatically generated )

A screenshot of a graph

Description automatically generated

T cells: TPR: 84.75% TNR: 99.86

Transferred majority: T cells

B cells: TPR: 99.23% TNR: 97.08

Transferred majority: B cells

Neutrophils: TPR: 60.53% TNR: 99.95

Transferred majority: Neutrophils

NK cells: TPR: 62.5% TNR: 99.09

Transferred majority: NK cells

CODEX cluster 1 transferred majority: 83.858 % T cells

CODEX cluster 2 transferred majority: 17.759 % B cells

CODEX cluster 3 transferred majority: 54.962 % Macrophages

CODEX cluster 4 transferred majority: 100.0 % B cells

CODEX cluster 5 transferred majority: 48.308 % B cells

CODEX cluster 6 transferred majority: 100.0 % B cells

CODEX cluster 7 transferred majority: 58.974 % Neutrophils

CODEX cluster 8 transferred majority: 69.153 % Macrophages

CODEX cluster 9 transferred majority: 98.742 % B cells

CODEX cluster 10 transferred majority: 95.96 % B cells

CODEX cluster 11 transferred majority: 99.441 % B cells

CODEX cluster 12 transferred majority: 22.034 % Macrophages

CODEX cluster 13 transferred majority: 49.492 % B cells

CODEX cluster 14 transferred majority: 98.759 % B cells

CODEX cluster 15 transferred majority: 59.055 % T cells

CODEX cluster 16 transferred majority: 100.0 % B cells

CODEX cluster 17 transferred majority: 96.721 % B cells

CODEX cluster 18 transferred majority: 98.477 % B cells

CODEX cluster 19 transferred majority: 61.538 % NK cells

CODEX cluster 20 transferred majority: 69.231 % Plasma cells

CODEX cluster 21 transferred majority: 99.445 % B cells

CODEX cluster 22 transferred majority: 94.805 % B cells

CODEX cluster 23 transferred majority: 99.379 % B cells

CODEX cluster 24 transferred majority: 74.766 % B cells

CODEX cluster 25 transferred majority: 99.043 % B cells

CODEX cluster 26 transferred majority: 100.0 % B cells

Kick out distant CODEX cells.

cn.pipeline(

# read\_codex args

codex\_blanks="../Data/raw\_dataset/codex\_blanks.csv",

codex\_protein="../Data/raw\_dataset/codex\_protein.csv",

codex\_size="../Data/raw\_dataset/codex\_size.csv",

codex\_spatial="../Data/raw\_dataset/codex\_spatial.csv",

codex\_preprocess=True,

codex\_border=564000,

# read\_cite args

cite\_latent="../Data/raw\_dataset/cite\_latent.csv",

cite\_protein="../Data/raw\_dataset/cite\_protein.csv",

cite\_mrna="../Data/raw\_dataset/cite\_mRNA.csv",

# take\_subset args

amount\_codex=-1, # -1 = default ≈ 9000 CODEX cells

amount\_cite=-1, # -1 ≈ 7000 cells

# filter\_codex args

size\_lim=(1000, 25000),

blank\_lower=(-1200, -1200, -1200, -1200),

blank\_upper=(6000, 2500, 5000, 2500),

# clean\_cite args

maxit=500,

factr=1e-9,

optim\_init=([10, 60, 2, 0.5, 0.5],

[4.8, 50, 0.5, 2, 0.5],

[2, 18, 0.5, 2, 0.5],

[1, 3, 2, 2, 0.5],

[1, 3, 0.5, 2, 0.5]),

ignore\_warnings=True,

clean\_cite\_method="l-bfgs-b",

# cluster\_codex args

cluster\_codex\_k=5,

cluster\_codex\_knn\_option=1,

# parameter\_scan args

parameter\_scan\_min\_cluster\_size\_range=tuple(range(5, 21, 4)),

parameter\_scan\_min\_sample\_range=tuple(range(10, 41, 3)),

parameter\_scan\_n\_neighbors=50,

parameter\_scan\_min\_dist=0.1,

A screenshot of a graph

Description automatically generated parameter\_scan\_negative\_sample\_rate=50,

parameter\_scan\_metric="correlation",

# consensus\_cluster args

consensus\_cluster\_silhouette\_cutoff=0.126,

consensus\_cluster\_inconsistent\_value=0.1,

consensus\_cluster\_min\_cluster\_size=10,

# map\_codex\_to\_cite args

k\_find\_nn=80,

k\_find\_anchor=20,

k\_filter\_anchor=100,

k\_score\_anchor=80,

k\_find\_weights=100,

# transfer\_matrix

k\_transfer\_matrix=None,

c\_transfer\_matrix=0.1,

mask=True

)

A screenshot of a graph

Description automatically generated

A screenshot of a cell phone

Description automatically generated

Around 9000 CODEX cells

A screenshot of a graph

Description automatically generated def test\_overall\_evaluation(self):

# initialize variable

cn = Controller.Controller()

# this pipeline will read files

cn.pipeline(

# read\_codex args

codex\_blanks="../Data/raw\_dataset/codex\_blanks.csv",

codex\_protein="../Data/raw\_dataset/codex\_protein.csv",

codex\_size="../Data/raw\_dataset/codex\_size.csv",

codex\_spatial="../Data/raw\_dataset/codex\_spatial.csv",

codex\_preprocess=True,

codex\_border=600000,

# read\_cite args

cite\_latent="../Data/raw\_dataset/cite\_latent.csv",

cite\_protein="../Data/raw\_dataset/cite\_protein.csv",

cite\_mrna="../Data/raw\_dataset/cite\_mRNA.csv",

# take\_subset args

amount\_codex=-1, # -1 = default ≈ 9000 CODEX cells

amount\_cite=-1, # -1 ≈ 7000 cells

# filter\_codex args

size\_lim=(1000, 25000),

blank\_lower=(-1200, -1200, -1200, -1200),

blank\_upper=(6000, 2500, 5000, 2500),

# clean\_cite args

maxit=500,

factr=1e-9,

optim\_init=([10, 60, 2, 0.5, 0.5],

[4.8, 50, 0.5, 2, 0.5],

[2, 18, 0.5, 2, 0.5],

[1, 3, 2, 2, 0.5],

[1, 3, 0.5, 2, 0.5]),

ignore\_warnings=True,

clean\_cite\_method="l-bfgs-b",

# cluster\_codex args

cluster\_codex\_k=5,

cluster\_codex\_knn\_option=1,

# parameter\_scan args

parameter\_scan\_min\_cluster\_size\_range=tuple(range(5, 21, 4)),

parameter\_scan\_min\_sample\_range=tuple(range(10, 41, 3)),

parameter\_scan\_n\_neighbors=50,

parameter\_scan\_min\_dist=0.1,

parameter\_scan\_negative\_sample\_rate=50,

parameter\_scan\_metric="correlation",

# consensus\_cluster args

consensus\_cluster\_silhouette\_cutoff=0.126,

consensus\_cluster\_inconsistent\_value=0.1,

consensus\_cluster\_min\_cluster\_size=10,

# map\_codex\_to\_cite args

T cells: TPR: 90.52% TNR: 99.53%

Transferred majority: T cells

B cells: TPR: 99.47% TNR: 93.68%

Transferred majority: B cells

Neutrophils: TPR: 61.76% TNR: 99.97%

Transferred majority: Neutrophils

NK cells: TPR: 57.14% TNR: 99.45%

Transferred majority: NK cells

CODEX cluster 1 transferred majority: 84.153 % T cells

CODEX cluster 2 transferred majority: 57.285 % B cells

CODEX cluster 3 transferred majority: 100.0 % B cells

CODEX cluster 4 transferred majority: 34.541 % B cells

CODEX cluster 5 transferred majority: 97.602 % B cells

CODEX cluster 6 transferred majority: 99.04 % B cells

CODEX cluster 7 transferred majority: 56.757 % Neutrophils

CODEX cluster 8 transferred majority: 63.277 % B cells

CODEX cluster 9 transferred majority: 41.558 % Erythrocytes

CODEX cluster 10 transferred majority: 56.738 % NK cells

CODEX cluster 11 transferred majority: 91.441 % B cells

CODEX cluster 12 transferred majority: 93.137 % B cells

CODEX cluster 13 transferred majority: 60.635 % T cells

CODEX cluster 14 transferred majority: 99.06 % B cells

CODEX cluster 15 transferred majority: 92.949 % T cells

CODEX cluster 16 transferred majority: 99.333 % B cells

CODEX cluster 17 transferred majority: 99.065 % B cells

CODEX cluster 18 transferred majority: 98.505 % B cells

CODEX cluster 19 transferred majority: 81.047 % B cells

CODEX cluster 20 transferred majority: 89.778 % B cells

CODEX cluster 21 transferred majority: 99.505 % B cells

CODEX cluster 22 transferred majority: 99.805 % B cells

k\_find\_nn=80,

k\_find\_anchor=20,

k\_filter\_anchor=100,

k\_score\_anchor=80,

k\_find\_weights=100,

# transfer\_matrix

k\_transfer\_matrix=None,

c\_transfer\_matrix=0.1,

mask=True

)

# invoke the partial evaluation

TestController.partial\_evaluation(cn.stvea, cn.annotation)

1. A purple and orange squares

   Description automatically generated

Around 4000 CODEX cells

# this pipeline will read files

cn.pipeline(

# read\_codex args

codex\_blanks="../Data/raw\_dataset/codex\_blanks.csv",

codex\_protein="../Data/raw\_dataset/codex\_protein.csv",

codex\_size="../Data/raw\_dataset/codex\_size.csv",

codex\_spatial="../Data/raw\_dataset/codex\_spatial.csv",

codex\_preprocess=True,

codex\_border=390000,

# read\_cite args

cite\_latent="../Data/raw\_dataset/cite\_latent.csv",

cite\_protein="../Data/raw\_dataset/cite\_protein.csv",

cite\_mrna="../Data/raw\_dataset/cite\_mRNA.csv",

# take\_subset args

amount\_codex=-1, # -1 = default ≈ 9000 CODEX cells

amount\_cite=-1, # -1 ≈ 7000 cells

# filter\_codex args

size\_lim=(1000, 25000),

blank\_lower=(-1200, -1200, -1200, -1200),

blank\_upper=(6000, 2500, 5000, 2500),

# clean\_cite args

maxit=500,

factr=1e-9,

optim\_init=([10, 60, 2, 0.5, 0.5],

[4.8, 50, 0.5, 2, 0.5],

[2, 18, 0.5, 2, 0.5],

[1, 3, 2, 2, 0.5],

[1, 3, 0.5, 2, 0.5]),

ignore\_warnings=True,

clean\_cite\_method="l-bfgs-b",

# cluster\_codex args

cluster\_codex\_k=5,

cluster\_codex\_knn\_option=1,

# parameter\_scan args

T cells: TPR: 87.56% TNR: 99.54%

Transferred majority: T cells

B cells: TPR: 97.7% TNR: 95.48%

Transferred majority: B cells

Neutrophils: TPR: 51.85% TNR: 100.0%

Transferred majority: Neutrophils

NK cells: TPR: 88.57% TNR: 98.22%

Transferred majority: NK cells

CODEX cluster 1 transferred majority: 86.275 % T cells

CODEX cluster 2 transferred majority: 47.059 % B cells

CODEX cluster 3 transferred majority: 30.252 % B cells

CODEX cluster 4 transferred majority: 100.0 % B cells

CODEX cluster 5 transferred majority: 85.714 % B cells

CODEX cluster 6 transferred majority: 95.977 % B cells

CODEX cluster 7 transferred majority: 51.852 % Neutrophils

CODEX cluster 8 transferred majority: 61.6 % B cells

CODEX cluster 9 transferred majority: 31.0 % B cells

CODEX cluster 10 transferred majority: 87.324 % NK cells

CODEX cluster 11 transferred majority: 44.156 % B cells

CODEX cluster 12 transferred majority: 93.452 % B cells

CODEX cluster 13 transferred majority: 99.153 % B cells

CODEX cluster 14 transferred majority: 56.25 % T cells

CODEX cluster 15 transferred majority: 46.552 % B cells

CODEX cluster 16 transferred majority: 85.926 % T cells

CODEX cluster 17 transferred majority: 94.604 % B cells

CODEX cluster 18 transferred majority: 97.84 % B cells

CODEX cluster 19 transferred majority: 78.571 % NK cells

CODEX cluster 20 transferred majority: 78.261 % B cells

CODEX cluster 21 transferred majority: 100.0 % B cells

CODEX cluster 22 transferred majority: 82.222 % B cells

CODEX cluster 23 transferred majority: 99.194 % B cells

CODEX cluster 24 transferred majority: 99.415 % B cells

parameter\_scan\_min\_cluster\_size\_range=tuple(range(5, 21, 4)),

parameter\_scan\_min\_sample\_range=tuple(range(10, 41, 3)),

parameter\_scan\_n\_neighbors=50,

parameter\_scan\_min\_dist=0.1,

parameter\_scan\_negative\_sample\_rate=50,

parameter\_scan\_metric="correlation",

# consensus\_cluster args

consensus\_cluster\_silhouette\_cutoff=0.126,

consensus\_cluster\_inconsistent\_value=0.1,

consensus\_cluster\_min\_cluster\_size=10,

# map\_codex\_to\_cite args

k\_find\_nn=80,

k\_find\_anchor=20,

k\_filter\_anchor=100,

k\_score\_anchor=80,

k\_find\_weights=100,

# transfer\_matrix

k\_transfer\_matrix=None,

c\_transfer\_matrix=0.1,

mask=True

)

Around 2000 cells

cn.pipeline(

T cells: TPR: 91.95% TNR: 99.49%

Transferred majority: T cells

B cells: TPR: 95.71% TNR: 95.94%

Transferred majority: B cells

NK cells: TPR: 52.17% TNR: 98.72%

Transferred majority: NK cells

CODEX cluster 1 transferred majority: 91.304 % T cells

CODEX cluster 2 transferred majority: 29.412 % Erythroblasts

CODEX cluster 3 transferred majority: 98.565 % B cells

CODEX cluster 4 transferred majority: 75.0 % B cells

CODEX cluster 5 transferred majority: 39.706 % B cells

CODEX cluster 6 transferred majority: 93.396 % B cells

CODEX cluster 7 transferred majority: 67.347 % NK cells

CODEX cluster 8 transferred majority: 53.049 % B cells

CODEX cluster 9 transferred majority: 63.158 %

CODEX cluster 10 transferred majority: 68.657 % B cells

CODEX cluster 11 transferred majority: 23.529 % Monocytes

CODEX cluster 12 transferred majority: 80.488 % B cells

CODEX cluster 13 transferred majority: 61.039 % B cells

CODEX cluster 14 transferred majority: 89.412 % T cells

CODEX cluster 15 transferred majority: 63.043 % B cells

CODEX cluster 16 transferred majority: 52.174 % NK cells

CODEX cluster 17 transferred majority: 95.205 % B cells

CODEX cluster 18 transferred majority: 89.109 % B cells

CODEX cluster 19 transferred majority: 71.93 % B cells

CODEX cluster 20 transferred majority: 96.825 % B cells

CODEX cluster 21 transferred majority: 99.02 % B cells

# read\_codex args

codex\_blanks="../Data/raw\_dataset/codex\_blanks.csv",

codex\_protein="../Data/raw\_dataset/codex\_protein.csv",

codex\_size="../Data/raw\_dataset/codex\_size.csv",

codex\_spatial="../Data/raw\_dataset/codex\_spatial.csv",

codex\_preprocess=True,

codex\_border=300000,

# read\_cite args

cite\_latent="../Data/raw\_dataset/cite\_latent.csv",

cite\_protein="../Data/raw\_dataset/cite\_protein.csv",

cite\_mrna="../Data/raw\_dataset/cite\_mRNA.csv",

# take\_subset args

amount\_codex=-1, # -1 = default ≈ 9000 CODEX cells

amount\_cite=-1, # -1 ≈ 7000 cells

# filter\_codex args

size\_lim=(1000, 25000),

blank\_lower=(-1200, -1200, -1200, -1200),

blank\_upper=(6000, 2500, 5000, 2500),

# clean\_cite args

maxit=500,

factr=1e-9,

optim\_init=([10, 60, 2, 0.5, 0.5],

[4.8, 50, 0.5, 2, 0.5],

[2, 18, 0.5, 2, 0.5],

[1, 3, 2, 2, 0.5],

[1, 3, 0.5, 2, 0.5]),

ignore\_warnings=True,

clean\_cite\_method="l-bfgs-b",

# cluster\_codex args

cluster\_codex\_k=5,

A purple and yellow squares

Description automatically generated cluster\_codex\_knn\_option=1,

# parameter\_scan args

parameter\_scan\_min\_cluster\_size\_range=tuple(range(5, 21, 4)),

parameter\_scan\_min\_sample\_range=tuple(range(10, 41, 3)),

parameter\_scan\_n\_neighbors=50,

parameter\_scan\_min\_dist=0.1,

parameter\_scan\_negative\_sample\_rate=50,

parameter\_scan\_metric="correlation",

# consensus\_cluster args

consensus\_cluster\_silhouette\_cutoff=0.126,

consensus\_cluster\_inconsistent\_value=0.1,

consensus\_cluster\_min\_cluster\_size=10,

# map\_codex\_to\_cite args

k\_find\_nn=80,

k\_find\_anchor=20,

k\_filter\_anchor=100,

k\_score\_anchor=80,

k\_find\_weights=100,

# transfer\_matrix

k\_transfer\_matrix=None,

c\_transfer\_matrix=0.1,

mask=True

)