A Fuzzy-PID Controller-guided Stochastic Gradient Descent for High-Dimensional Incomplete Matrix Latent Factor Analysis: Supplementary File

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I. Introduction

THIS is the supplementary file for paper entitled *"A Fuzzy-PID Controller-guided Stochastic Gradient Descent for High-Dimensional Incomplete Matrix Latent Factor Analysis"*. It provides Table S1 for symbol appointment and Table S2 for hyperparameter settings of each competitor.

II. Supplementary Hyperparameter Settings

TABLE S1
SYMBOL APPOINTMENT

Symbol	Definition
R	An HDI matrix.
$\hat{R}$	The rank-f approximation matrix of R.
U, V	The node sets of R.
u, v	Nodes in U and V.
r_{uv}, $\hat{r}_{uv}$	An element in R and $\hat{R}$.
e_{uv}	The instant error between r_{uv} and $\hat{r}_{uv}$.
$E^{(t)}$	The t-th iteration evaluation error.
Λ	The set of known entries in R.
Ω, Ψ, Φ	Training, test, validation sets from Λ.
P, Q	LF matrices.
$\mathbf{p}_u$, $\mathbf{q}_v$	The u-th and v-th row vectors in P and Q.
$<\cdot,\cdot>$	The inner product of two vectors.
$\lvert\cdot\rvert$	The cardinality of an enclosed set.
$\lvert\lvert\cdot\rvert\rvert_2$	The L_2 norm of an enclosed vector.
$\lvert\cdot\rvert_{abs}$	The absolute value of a number.
f	LF dimension.
λ	Regularization coefficient.
γ	Learning rate.
K_P	Proportion gain in the PID controller.
K_I	Integral gain in the PID controller.
K_D	Derivative gain in the PID controller.

TABLE S2
HYPERPARAMETER SETTINGS FOR COMPETITORS

Abbr.	M2	M3	M4	M5	M6	M7	M8	M9	M10
D1	γ=2e-2, λ=7e-1, K_P=5e-1, K_I=5e-4, K_D=5e-4	γ=2e-2, λ=7e-1, K_P=5e-5, K_D=5e-5	γ=2e-2, λ=7e-1	γ=9e-4, λ=9e-1, β=9e-1	γ=9e-4, λ=9e-1, β=9e-1	γ=9e-1, λ=8e-1, ϵ=1e-8	γ=8e-3, λ=7e-1, β=9e-1, ϵ=1e-8	γ=3e-2, λ=9e-1, β_1=9e-1, β_2=9.99e-1, ϵ=1e-8	γ=5e-2, λ=8e-1, β_1=9e-1, β_2=9.99e-1, ϵ=1e-8
D2	γ=3e-2, λ=4e-2, K_P=5e-1, K_I=5e-4, K_D=5e-2	γ=3e-2, λ=4e-2, K_P=5e-5, K_D=5e-3	γ=3e-2, λ=4e-2	γ=3e-3, λ=4e-2, β=9e-1	γ=3e-3, λ=4e-2, β=9e-1	γ=8e-2, λ=4e-2, ϵ=1e-8	γ=1e-3, λ=4e-2, β=9e-1, ϵ=1e-8	γ=9e-3, λ=7e-2, β_1=9e-1, β_2=9.99e-1, ϵ=1e-8	γ=6e-3, λ=4e-2, β_1=9e-1, β_2=9.99e-1, ϵ=1e-8
D3	γ=8e-3, λ=3e-1, K_P=5e-1, K_I=5e-4, K_D=5e-4	γ=8e-3, λ=3e-1, K_P=5e-4, K_D=5e-4	γ=8e-3, λ=3e-1	γ=9e-4, λ=3e-1, β=9e-1	γ=9e-4, λ=3e-1, β=9e-1	γ=1e-1, λ=3e-1, ϵ=1e-8	γ=4e-3, λ=4e-2, β=9e-1, ϵ=1e-8	γ=7e-3, λ=3e-1, β_1=9e-1, β_2=9.99e-1, ϵ=1e-8	γ=9e-3, λ=3e-1, β_1=9e-1, β_2=9.99e-1, ϵ=1e-8
D4	γ=2e-2, λ=9e-2, K_P=5e-1, K_I=5e-4, K_D=5e-1	γ=2e-2, λ=9e-2, K_P=5e-4, K_D=5e-4	γ=2e-2, λ=9e-2	γ=2e-3, λ=9e-2, β=9e-1	γ=2e-3, λ=9e-2, β=9e-1	γ=5e-2, λ=3e-1, ϵ=1e-8	γ=5e-3, λ=2e-1, β=9e-1, ϵ=1e-8	γ=8e-3, λ=3e-1, β_1=9e-1, β_2=9.99e-1, ϵ=1e-8	γ=8e-3, λ=3e-1, β_1=9e-1, β_2=9.99e-1, ϵ=1e-8
D5	γ=2e-2, λ=8e-1, K_P=5e-1, K_I=5e-4, K_D=5e-1	γ=2e-2, λ=8e-1, K_P=5e-4, K_D=5e-4	γ=2e-2, λ=8e-1	γ=9e-4, λ=9e-1, β=9e-1	γ=9e-4, λ=9e-1, β=9e-1	γ=4e-1, λ=6e-1, ϵ=1e-8	γ=9e-3, λ=8e-1, β=9e-1, ϵ=1e-8	γ=2e-2, λ=9e-1, β_1=9e-1, β_2=9.99e-1, ϵ=1e-8	γ=4e-2, λ=9e-1, β_1=9e-1, β_2=9.99e-1, ϵ=1e-8
D6	γ=8e-3, λ=5e-2, K_P=5e-1, K_I=5e-3, K_D=5e-5	γ=8e-3, λ=5e-2, K_P=5e-5, K_D=5e-4	γ=8e-3, λ=5e-2	γ=5e-4, λ=9e-2, β=9e-1	γ=9e-4, λ=6e-2, β=9e-1	γ=3e-2, λ=1e-2, ϵ=1e-8	γ=9e-4, λ=6e-2, β=9e-1, ϵ=1e-8	γ=8e-3, λ=5e-2, β_1=9e-1, β_2=9.99e-1, ϵ=1e-8	γ=9e-3, λ=6e-2, β_1=9e-1, β_2=9.99e-1, ϵ=1e-8