Figure 1: (Upper)The number of parameters of each model (Lorenz-96, p=100, T=1000). (Bottom) The trend of KANGCI's parameter as the time series dimension increases.

Table 1: AUPRC of the Lorenz-96 dataset.

Models	AUROC		
	$p = 10, F = 10$ $T = 1000$	$p = 40, F = 40$ $T = 1000$	$p = 40, F = 40$ $T = 500$
cMLP	$0.968_{\pm 0.002}$	$0.791_{\pm 0.012}$	$0.685_{\pm 0.057}$
cLSTM	$0.964_{\pm 0.004}$	$0.865_{\pm 0.015}$	$0.726_{\pm 0.035}$
TCDF	$0.732_{\pm 0.012}$	$0.524_{\pm 0.042}$	$0.445_{\pm 0.122}$
eSRU	$\mathbf{1.0_{\pm 0.00}}$	$0.943_{\pm 0.007}$	$0.893_{\pm 0.023}$
GVAR	$\mathbf{1.0_{\pm 0.00}}$	$0.925_{\pm 0.009}$	$0.886_{\pm 0.036}$
NAVAR (MLP)	$0.989_{\pm 0.005}$	$0.742_{\pm 0.041}$	$0.631_{\pm 0.079}$
NAVAR (LSTM)	$0.991_{\pm 0.005}$	$0.784_{\pm 0.037}$	$0.682_{\pm 0.071}$
JGC	$0.987_{\pm 0.004}$	$0.923_{\pm 0.029}$	$0.843_{\pm 0.044}$
CUTS+	$\mathbf{1.0_{\pm 0.00}}$	$0.979_{\pm 0.003}$	$0.925_{\pm 0.024}$
JRNGC	$\mathbf{1.0_{\pm 0.00}}$	$0.966_{\pm 0.006}$	$0.892_{\pm 0.035}$
KANGCI	$\mathbf{1.0_{\pm 0.00}}$	$\mathbf{0.990_{\pm 0.003}}$	$\mathbf{0.953_{\pm 0.021}}$

Table 2: AUPRC of the Dream-3 dataset, T=966, p=100

Models	AUROC				
	Ecoli-1	Ecoli-2	Yeast-1	Yeast-2	Yeast-3
cMLP	0.023	0.019	0.020	0.015	0.014
cLSTM	0.017	0.017	0.015	0.023	0.031
TCDF	0.012	0.011	0.014	0.014	0.013
eSRU	0.036	0.034	0.041	0.052	0.044
GVAR	0.103	0.117	0.098	0.103	0.104
NAVAR (MLP)	0.102	0.107	0.073	0.105	0.089
NAVAR (LSTM)	0.013	0.012	0.030	0.038	0.052
JGC	0.018	0.016	0.026	0.050	0.059
CUTS+	0.154	0.143	0.121	0.128	0.105
JRNGC	**0.198**	**0.202**	**0.172**	**0.142**	0.130
KANGCI	0.177	0.163	0.154	0.138	**0.132**

Table 3: AUPRC of the VAR dataset.

Models	AUROC		
	$p = 10, T = 1000$ $sparsity = 0.2$ $lag = 3$	$p = 10, T = 1000$ $sparsity = 0.3$ $lag = 3$	$p = 10, T = 1000$ $sparsity = 0.2$ $lag = 5$
cMLP	$\mathbf{1.0_{\pm 0.00}}$	$0.832_{\pm 0.006}$	$0.973_{\pm 0.004}$
cLSTM	$0.964_{\pm 0.005}$	$0.854_{\pm 0.006}$	$0.911_{\pm 0.006}$
TCDF	$0.812_{\pm 0.013}$	$0.681_{\pm 0.012}$	$0.734_{\pm 0.012}$
eSRU	$\mathbf{1.0_{\pm 0.00}}$	$0.989_{\pm 0.002}$	$\mathbf{1.0_{\pm 0.00}}$
GVAR	$\mathbf{1.0_{\pm 0.00}}$	$0.985_{\pm 0.003}$	$\mathbf{1.0_{\pm 0.00}}$
NAVAR (MLP)	$0.987_{\pm 0.003}$	$0.943_{\pm 0.006}$	$0.981_{\pm 0.004}$
NAVAR (LSTM)	$0.985_{\pm 0.003}$	$0.957_{\pm 0.007}$	$0.959_{\pm 0.003}$
JGC	$\mathbf{1.0_{\pm 0.00}}$	$0.990_{\pm 0.002}$	$\mathbf{1.0_{\pm 0.00}}$
CUTS+	$\mathbf{1.0_{\pm 0.00}}$	$\mathbf{1.0_{\pm 0.00}}$	$\mathbf{1.0_{\pm 0.00}}$
JRNGC	$\mathbf{1.0_{\pm 0.00}}$	$0.992_{\pm 0.002}$	$\mathbf{1.0_{\pm 0.00}}$
KANGCI	$\mathbf{1.0_{\pm 0.00}}$	$0.987_{\pm 0.002}$	$\mathbf{1.0_{\pm 0.00}}$

Table 4: AUPRC of the fMRI BOLD

| Dateset	AUROC		
	CUTS+	JRNGC	**KANGCI**
Sim1	**0.704**±**0.08**	0.688±0.07	0.672±0.09
Sim2	0.694±0.07	0.682±0.06	**0.701**±**0.07**
Sim3	0.638±0.07	**0.651**±**0.08**	0.636±0.06
Sim4	**0.643**±**0.06**	0.632±0.06	0.601±0.03
Sim5	0.728±0.05	0.731±0.06	**0.739**±**0.05**
Sim6	0.734±0.06	0.729±0.07	**0.748**±**0.07**
Sim7	0.744±0.07	0.721±0.07	**0.793**±**0.07**
Sim8	0.635±0.08	0.621±0.04	**0.654**±**0.11**
Sim9	0.698±0.05	0.685±0.05	**0.719**±**0.08**
Sim10	0.678±0.04	0.663±0.08	**0.692**±**0.09**
Sim11	**0.695**±**0.05**	0.682±0.08	0.621±0.07
Sim12	0.660±0.06	0.649±0.07	**0.678**±**0.06**
Sim13	0.696±0.05	0.720±0.08	**0.744**±**0.08**
Sim14	0.657±0.04	0.642±0.06	**0.686**±**0.09**
Sim15	0.641±0.07	0.632±0.09	**0.659**±**0.07**
Sim16	0.654±0.11	0.668±0.12	**0.688**±**0.09**
Sim17	**0.724**±**0.04**	0.721±0.05	0.714±0.05
Sim18	0.710±0.06	0.696±0.08	**0.725**±**0.09**
Sim19	0.847±0.07	0.833±0.04	**0.873**±**0.03**
Sim20	0.861±0.07	0.857±0.05	**0.886**±**0.04**
Sim21	0.696±0.08	0.677±0.06	**0.711**±**0.07**
Sim22	0.727±0.04	0.722±0.06	**0.746**±**0.09**
Sim23	**0.551**±**0.06**	0.544±0.08	0.527±0.11
Sim24	0.490±0.08	**0.504**±**0.08**	0.476±0.09
Sim25	0.643±0.05	0.649±0.07	**0.661**±**0.08**
Sim26	0.561±0.09	0.561±0.08	**0.632**±**0.12**
Sim27	0.661±0.07	0.634±0.09	**0.672**±**0.08**
Sim28	0.715±0.09	0.709±0.10	**0.732**±**0.09**
AVG	0.681±0.07	0.675±0.09	**0.691**±**0.09**
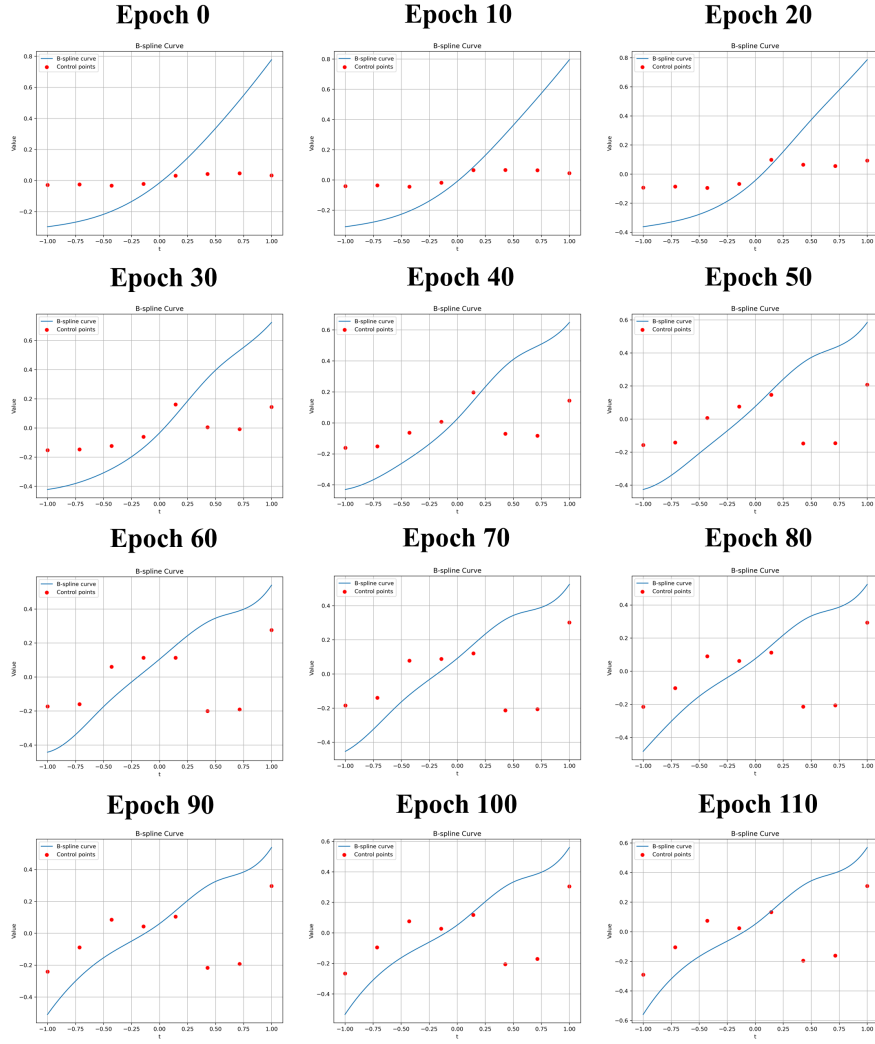
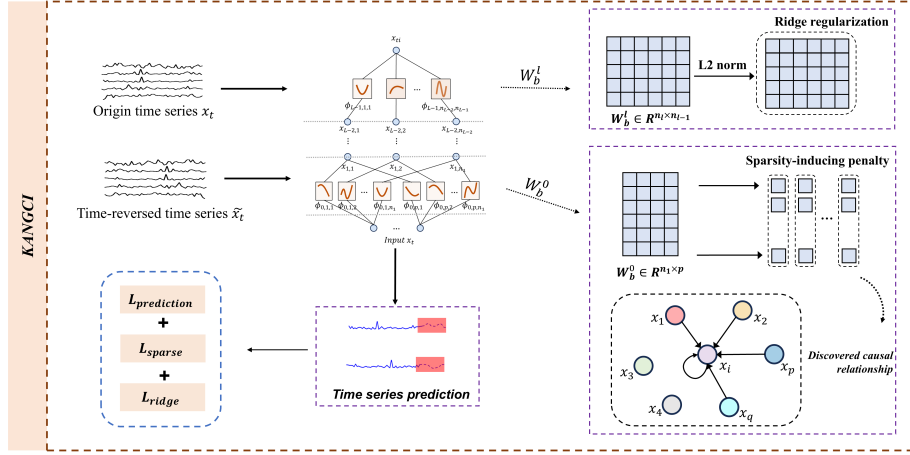Figure 2: The visualization of the $spline(x)$ function during the causal inference.

Figure 3: The architecture of KANGCI.