A neural network-based production process modeling and variable importance analysis approach in corn to sugar factory

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Supporting Information

Table A1. The number and name of all the sites

Number	Name	Number	Name
X1	Content of moldy grains	X58	PID1\TICA_1403_7-PV
X2	Fragment of grain (%)	X59	TEMPR1\TI_301A
X3	Total moisture (%)	X60	CURRENT1\CIA_1504_1
X4	Dry matter content in 14.08-2 (%)	X61	CURRENT1\CIA_1520_2
X5	Dry matter content in 14.78-1 (%)	X62	CURRENT1\CIA_1647_1
X6	Dry matter content in 14.78 (%)	X63	CURRENT1\CIA_1520_7
X7	Bonded starch D.S in 15.71 (%)	X64	CURRENT1\CIA_1671_2
X8	Bonded starch D.S in 15.46 (%)	X65	PID2\FICA_1508-PV
X9	Free starch D.S in 15.46 (%)	X66	PID1\FICA_1687_1-PV
X10	The moisture in 2# (%)	X67	FLOW2\FIA_1639
X11	The moisture in 3# (%)	X68	VALVOP\HV_1504_4
X12	The SO_2 content (ppm)	X69	LEVEL2\LIA_1590
X13	15.05 (Be)	X70	LEVEL2\LIA_1694_1
X14	15.12 (Be)	X71	LEVEL2\LIA_1694_2
X15	16.35 (Be)	X72	LEVEL2\LIA_1603
X16	16.75 (Be)	X73	LEVEL2\LIA_1658
X17	The moisture in 18.01-1 (%)	X74	CURRENT1\CIA_2002_2
X18	The moisture in 19.01 (%)	X75	CURRENT1\CIA_1625_1
X19	The moisture in 20.01-1/2 (%)	X76	CURRENT1\CIA_1625_2
X20	Be value of the soaking liquid before pulping	X77	CURRENT1\CIA_2011_3
X21	Acidity of old acid (%)	X78	CURRENT1\CIA_1569_5
X22	Corn tank after soaking	X79	PID1\FIC_2001_3-PV
X23	The moisture of corn after soaking (%)	X80	PID2\FIC_1541_2-PV
X24	SO_2 content of corn after soaking (ppm)	X81	FLOW1\FI_6
X25	Top flow dry matter in 15.95-1 (%)	X82	FLOW1\FI_1665
X26	Top flow dry matter in 16.07-1 (%)	X83	LEVEL1\LIA_1631

X27	Dry matter in 16.21 (%)	X84	PRESSURE1\PIA_2001_1
X28	PID1\LICA_1688_1-PV	X85	PRESSURE1\PIA_2001_3
X29	LEVEL1\LIA_1684	X86	PID1\TICA_2001_1-PV
X30	PRESSURE1\PIA_2110_1	X87	TEMPR1\TE_2001_6
X31	PRESSURE1\PIA_2110_2	X88	FI1104SD-1
X32	PRESSURE1\PIA_2110_4	X89	FI1104
X33	PRESSURE1\PIA_2112_3	X90	SIC6119.MV
X34	PID1\PICA_3-PV	X91	SIC1127.MV
X35	PID1\TICSA_2110_6-PV	X92	AI1102
X36	TEMPR1\TIA_3	X93	DS1103
X37	CURRENT1\CIA_1404	X94	TC1107_1.MV
X38	CURRENT1\CIA_1458_2	X95	PIC1106
X39	CURRENT1\CIA_1464_2	X96	TIC1107
X40	LEVEL1\LIA_1401_1_4	X97	PDI1109
X41	LEVEL1\LIA_1401_1_5	X98	PI1111
X42	LEVEL1\LIA_1401_1_12	X99	FIC1114_1.MV
X43	PID1\LIC1401_2_12-PV	X100	SIC2106.MV
X44	PID1\LIC1401_2_3-PV	X101	LIA2103_1
X45	PID1\LIC1401_2_5-PV	X102	LIA2103_2
X46	PID1\LIC1401_2_7-PV	X103	LIA2103_3
X47	PID1\LIC_301B-PV	X104	TI2103_4_1
X48	PID1\LIC_501A-PV	X105	TI2103_5_2
X49	PID1\LIC_502A-PV	X106	LIA2103_5
X50	PID1\LIC_502B-PV	X107	TI2103_6_2
X51	PID1\LIC_302A-PV	X108	LIA2103_7
X52	LEVEL1\LIA_1473_1	X109	LIA2103_8
X53	LEVEL1\LT_1401_3_9	X110	FIC2104_1
X54	LEVEL2\LIA_1401_3_2	X111	FIC2104_2
X55	PRESSURE1\PI_104A	X112	V1102 (5.5-6.2)
X56	PRESSURE1\PIA_201A	X113	The dry matter
X57	PID1\TICA_1403_6-PV	X114	Flow rates of glucoamylase (g/min)

Table A2. The criterions used of training results

	loss	accuracy	MSE	Loss of validation set	Accuracy of validation set	MSE of validation set
RNN	0.0010	0.0079	0.0010	0.0015	0.0019	0.0015
MLP	0.0017	0.0119	0.0063	0.0019	0.0135	0.0086
CNN	0.0014	0.0120	0.0054	0.0016	0.0094	0.0126

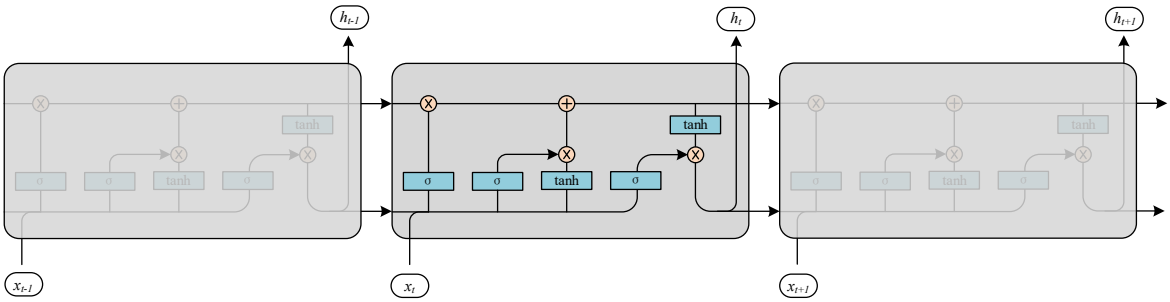

Fig. A1. LSTM structure diagram containing four interactive gates

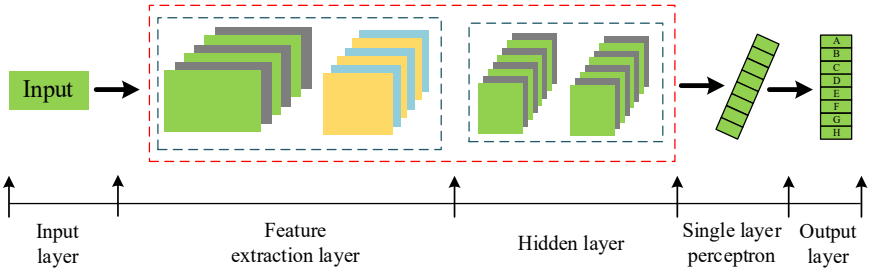

Fig. A2. CNN structure diagram