

원 저

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A Study on the Characteristics of Prematurely Discharged Patients and the Model for Predicting Premature Discharge

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Abstract

Background : We developed a model for predicting premature discharge and identifying related factors.

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Methods : Prediction model was developed by data mining techniques. Basic data were collected from the total discharge data base of a university hospital in Chungnam Province during the period from July 1, 1999 to June 30, 2000.

Results :

1. Among 22,873 patients, the number of patients discharged with usual discharge orders were 21,695 or 94.8%. The number of the prematurely discharged patients were 1,178 or 5.2%.
2. The primary reason for unusual discharge was transfer to other hospital. Move to a local hospital closer to their home and burdensome medical expenses were main reasons.
3. Predictability of each model was tested using the top 10 percent of patients with the highest probabilities of premature discharge. The neural network model was chosen as the most appropriate model for predicting prematurely discharged patients.
4. Ten percent of the total number of patients had been selected randomly to test the effectiveness of the neural network model. We have chosen the threshold of the neural network model as 0.7. The number of patients who were expected to discharge prematurely was 312. Among them, 241 had been discharged prematurely (77.2%).

Conclusion : Of the several data mining techniques used, the neural network model was the most effective, It can be used to identify and manage the patients who are expected to discharge prematurely.

Key Words : Data Mining, Patient Discharge, UHDDS

, 4 , 18 .

(가 , 17 ;) .

가 , 3.

10% , 40% , 30% 가 30%

40% ,

40%

1. , 30% ,

1999 7 1 2000 6 30 가

1 D .

22,873 , 1999 7 가

2000 7 가

가 1 .

2.

4.

UHDDS

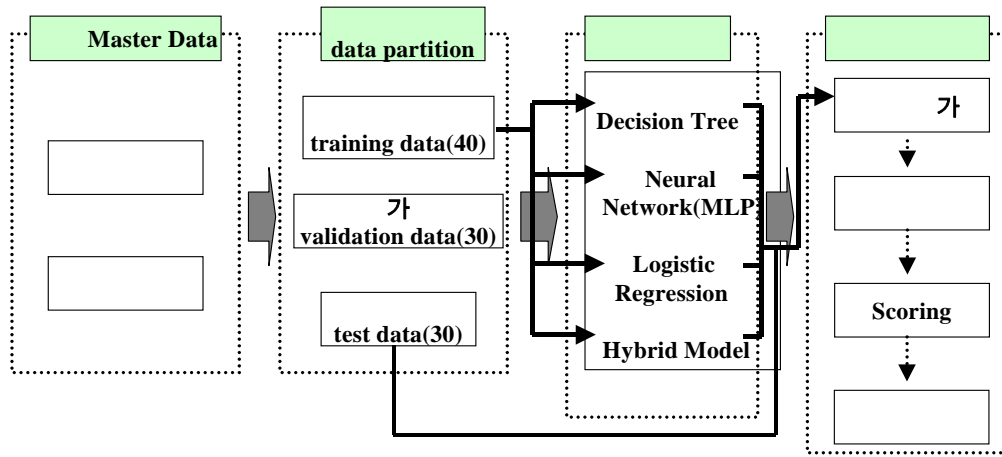
(11), (1), (12)

, , , 4 , , ,

20 5 , , , SAS(ver. Enterprise

, , 20 , , 15 6.12) SAS

5 , , , Miner(ver. 3.01)



1.

5.

2.

1

가 .
(target patient)가 10%

2.1 가 ,
22,873 ,
(target patient)가 10%
2,289 , 가

1.

21,695 (94.8%) 22,873 ,
1,178 (5.2%)

2

40% , 가 30% 가
가

가
(1).

2.2

20 , 20 , ,

(2).

1.

: N(%)

	11,482(52.9)	768(65.2)	12,250(53.6)
	10,213(47.1)	410(34.8)	10,623(46.4)
9	3,813(17.6)	76(6.5)	3,889(17.0)
10 19	1,201(5.5)	43(3.7)	1,244(5.4)
20 29	2,941(13.6)	146(12.4)	3,087(13.5)
30 39	3,158(14.6)	161(13.7)	3,319(14.5)
40 49	2,664(12.3)	158(13.4)	2,822(12.3)
50 59	2,885(13.3)	177(15.0)	3,062(13.4)
60	5,033(23.2)	417(35.4)	5,450(23.8)
	21,695(100.0)	1,178(100.0)	22,873(100.0)
	(94.8)	(5.2)	(100.0)

2.

: N(%)

	가 (training data)	(validation data)	(test data)	
	41(40.0)	31(30.0)	31(30.0)	103(100.0)
	874(40.0)	656(30.0)	656(30.0)	2,186(100.0)
	915(40.0)	687(30.0)	687(30.0)	2,289(100.0)

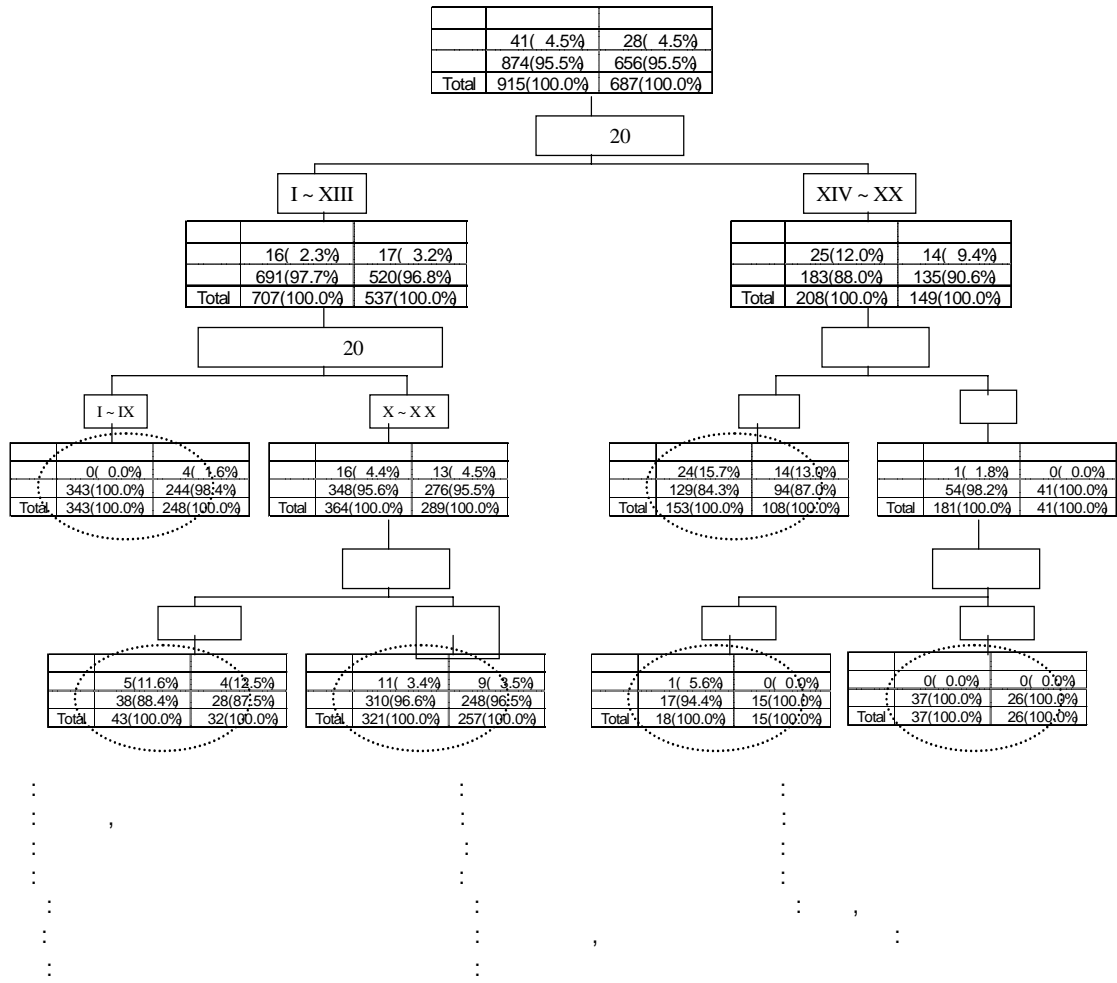
2.3

55.4% , 49.8%
(3).

3.

: N(%)

456(99.8)	1(0.2)	457(100.0)	341(99.4)	2(0.6)	343(100.0)
(52.8)	(1.9)	(49.9)	(49.9)	(66.7)	(49.9)
407(88.9)	51(11.1)	458(100.0)	343(99.7)	1(0.3)	344(100.0)
(47.2)	(98.1)	(50.1)	(50.1)	(33.3)	(50.1)
863(94.3)	52(5.7)	915(100.0)	684(99.6)	3(0.4)	687(100.0)
(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
		: 55.4%			: 49.8%



2.4

2.

73.0% , 71.8% (4).

4.

: N(%)

274(60.0)	183(40.0)	457(100.0)	213(62.1)	130(37.9)	343(100.0)	
(81.1)	(31.7)	(49.9)	(76.9)	(31.7)	(49.9)	
64(14.0)	394(86.0)	458(100.0)	64(18.6)	280(81.4)	344(100.0)	
(18.9)	(68.3)	(50.1)	(23.1)	(68.3)	(50.1)	
338(36.9)	577(63.1)	915(100.0)	277(40.3)	411(59.7)	687(100.0)	
(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	
: 73.0%			: 71.8%			

2.5 가
 72.8% , 66.4% (5).
 4.1
 3. 가 가
 66.9%,
 , 65.8% (7).
 73.0% 가 (6).

5. : N(%)

	303(66.3)	154(33.7)	457(100.0)	230(67.1)	113(32.9)	343(100.0)
	(76.1)	(29.8)	(49.9)	(66.1)	(33.3)	(49.9)
	95(20.7)	363(79.3)	458(100.0)	118(34.3)	226(65.7)	344(100.0)
	(23.9)	(70.2)	(50.1)	(33.9)	(66.7)	(50.1)
	398(43.5)	517(56.5)	915(100.0)	348(50.7)	339(49.3)	687(100.0)
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
	: 72.8%			: 66.4%		

6.

	73.0%	71.8%
	55.4%	49.8%
	72.8%	66.4%

7. : N(%)

	305(66.7)	152(33.3)	457(100.0)	231(67.3)	112(32.7)	
	(66.9)	(33.1)	(49.9)	(65.3)	(33.6)	
	151(33.0)	307(67.0)	458(100.0)	123(35.8)	221(64.2)	
	(33.1)	(66.9)	(50.1)	(34.7)	(66.4)	
	456(49.8)	459(50.2)	915(100.0)	354(51.5)	333(48.5)	
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	
	: 66.9%			: 65.8%		

4..2

72.6% ,
71.2% (8).

$$f[+ \sum_{j,k} w_{kj} f_h(\sum_{i,j} w_{ji} x_i)]$$

$$f \frac{1}{(1 + \exp(-x))}$$

가

5.

MLP

(3).

가

73.0%

가

(9).

$$f[+ \sum_{j,k} w_{kj} f_h(\sum_{i,j} w_{ji} x_i)]$$

$$= f(13.697575 + \sum_{j,k} w_{kj} 0.9587143)$$

$$= f(7.579697) = 0.99$$

6.

99

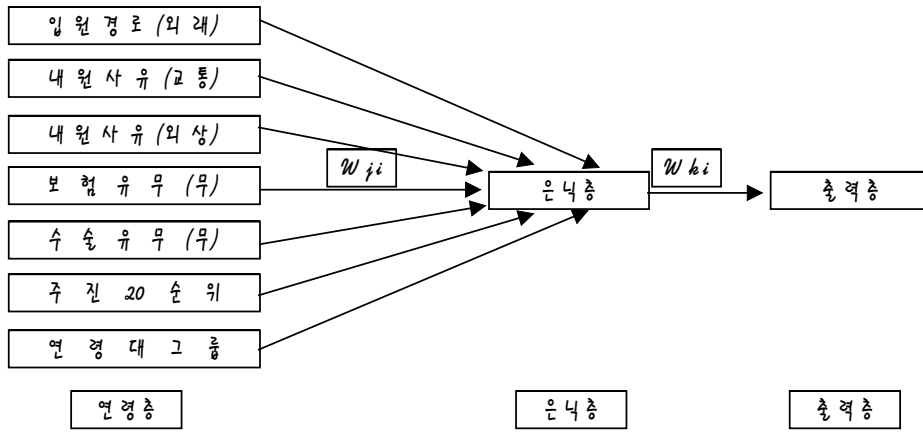
8.

: N(%)

	300(65.6)	157(34.4)	457(100.0)	238(67.3)	105(32.7)	343(100.0)
	(76.1)	(30.1)	(49.9)	(74.1)	(29.4)	(49.9)
	94(20.5)	364(79.5)	458(100.0)	83(24.1)	251(72.9)	344(100.0)
	(23.9)	(69.9)	(50.1)	(25.9)	(70.6)	(50.1)
	394(43.1)	521(56.9)	915(100.0)	321(46.7)	356(53.3)	687(100.0)
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
	: 72.6%			: 71.2%		

9.

/	73.0%	71.8%
	66.9%	65.8%
	72.6%	71.2%



3 MLP

7. threshold 241 (77.2%)
14.8 가 (10).

threshold 8.
threshold 0.7

5.2% ,
threshold 0.7 , 312

10. threshold

threshold	(/)	(/)
0.90	5.5%(25/458)	73.5%(25/ 34)
0.85	8.3%(38/458)	67.9%(38/ 56)
0.80	16.6%(76/458)	71.7%(76/106)
0.75	49.8%(228/458)	80.3%(228/284)
0.70	52.6%(241/458)	77.2%(241/312)
0.65	66.6%(305/458)	76.3%(305/400)
0.60	80.6%(369/458)	78.4%(381/486)
0.55	83.2%(381/458)	71.7%(386/538)
0.50	86.0%(394/458)	70.9%(395/557)

(19)

가 가 ,

(20)

(13). 가

(3)

(21)

가, Park

(22)

1.

(23) DB

22,873 , 21,695 (24)

1,178 5.2% 가

(14) 가 3.6%,

(15) 가 3.1% ,

(4)

가 11.2%,

(16) 1 21,652 가 가

가 6.6%

가 (25).

가

2.

가

()가 (

) (explanation)

(17), Greg (prediction)

Ellen(18) (26). Han(27)

(24)

(5)

3.

가 55.4% , 가 , 가 49.8% . 가 73.0% , 가 71.8% (29) 가 72.8% , 5. Scoring 66.4% 가 55.4%, 73.0% 가 72.8% . 5.2% , threshold 0.7 312 241 (77.2%) 가 14.8 가 (28). 66.9%, 65.8% 가 72.6%, 71.2% 가 1999 7 1 2000 6 30 1 D

4.

가 73.0% 가 1. 22,873 , 21,695 (94.8%) 1,178(5.2%) ,

가

2. , , (OECD , 2000) .
3. , , . 1999 . 2000; DB 6(2):1-6
4. 가 , 가 . 4. . 3 1998; 12-23
5. , . 1998;5(3):181-190
6. , , , , , , , .
5. threshold threshold QA , 2000;7(1):118-131
- 0.7 5.2% , 7. Frederick F, Sasser JR. Quality comes to Services. Harvard Business Review 1990; 105-111
- threshold 0.7 , 8. Giel K. Customer Satisfaction Measurement The Fundamental Building Blocks, Proceeding, AMA, Fifth Congress on Customer Satisfaction. 1994
- 312 241 (77.2%) 가 9. Kotler P, Clarke RN. Marketing for health care organization. Prentice-Hall, 1987
- 14.8 가 10. . 1995;34(4):83-91
- 가 , 가 11. (1999): (3) . , 1999
- 2000 OECD 12. , , , , , . 2000;169-180

13. QA 7, 2000; 1-15.
14. 1997;8(2):155-165
15. DB (). 2000;6(4):23-33
16. 1, 21,652, 1998; 35(4):371-379
17. SAS Enterprise Miner, 1999;33-45
18. Greg R Ellen J. Mining your data for health care quality improvement. SAS Institute Inc. 1998
19. 2000;7(2):25-36
20. (1999): 1999;5(3):169-179
21. , 2001
22. Park WS, Seo SW, Kim KH and Cho, YC For the Hospital the Intention of Medical Examination and Treatment Reservation System. Bulletin of the International Statistical Institute, 2001;3:5-6
23. CQI 2000;6(4):1-13
24. 2001;7(2):37-48
25. Murray S. Neural Networks for Statistical Modeling, International Thomson Computer Press. 1996
26. SAS Enterprise Miner, 1999;13-18
27. Han ST, Lee SK, Baek KR(2001): Case Study of Data Mining Process-The Case of Korean 'A' Bank Project. Bulletin of the International Statistical Institute, contributed papers, 2001;3: 181-182
28. SPSS (Neural Connection Answer Tree). SPSS 1998;1-13
29. , 2000