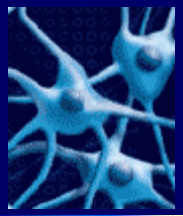

Artificial Neural Networks to Predict Patient's Length of Stay

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Why predict Length of Stay?

- Pre-admission authorization
- Bed-need assessment
- Concurrent review and discharge planning
- Reimbursement review and adjustment
- Identifying opportunities to reduce costs, save time and improve performance

- How computed today?
  - DRGs
  - ICD-9 codes
  - Insurance
  - Age groups

Traffic light Indicator in UNC EMR (WebCIS) census

User: RAJ GOPALAN - No Patient Selected ** Do Not Insert Into Chart ** WebCIS (2.9.03) - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites Media

Address https://unchweb4.unch.unc.edu:9443/WebCIS2903/mozilla/core_Frames.jsp Go

UNC HEALTH CARE

Hospital Service | Nursing Station | Primary Insurance | Attending Physician

Help Profile Print

New Patient
Patient Record
Orders

Activity List
Schedules

Patient Lists
Inpatient Census

Reference

Save&Exit
Exit

Help (966-5647)

WebCIS Admin

Inpatient Census

by Hospital Service: WELT SERVICE

New Query

Unit	Room & Bed	Patient Name	MRN	Sex	Age	Svc	Actual LOS	FC	Anticipated LOS	Physician Name
8BT	8333P1			F	54	MDW	37	B	3	LANTON ,PAMELA A
8BT	8329S2			M	81	MDW	2	M	4	OLDSTEIN ,BRIAN P
8BT	8311P1			F	97	MDW	4	M	3	LES ,EDMUND A
8BT	8308S2			F	78	MDW	10	R	3	LES ,EDMUND A
8BT	8305P1			M	52	MDW	2	P	3	OLDSTEIN ,BRIAN P
5BTB	5312P1			F	78	MDW	4	M	3	ATZ ,LAURENCE M
MPCU	4303P1			M	53	MDW	4	R	2	LES ,EDMUND A
3WST	3212S1			F	24	MDW	2	V	3	OLDSTEIN ,BRIAN P
3WST	3206S2			M	63	MDW	2	H	3	OLDSTEIN ,BRIAN P
3WST	3200P1			M	31	MDW	4	B	3	LES ,EDMUND A
PACU	2409P1			F	82	MDW	2	M	4	OLDSTEIN ,BRIAN P

New Query

no patient selected

start | circles.gif (GIF Imag... | Solucient: Insight to... | Microsoft PowerPoin... | untitled - Paint | User: RAJ GOPALAN... | 12:14 AM

What do we know about a patient @ admission

- Age
- Gender
- Ethnicity
- Religion
- City
- Insurance Info
- Dept/Division

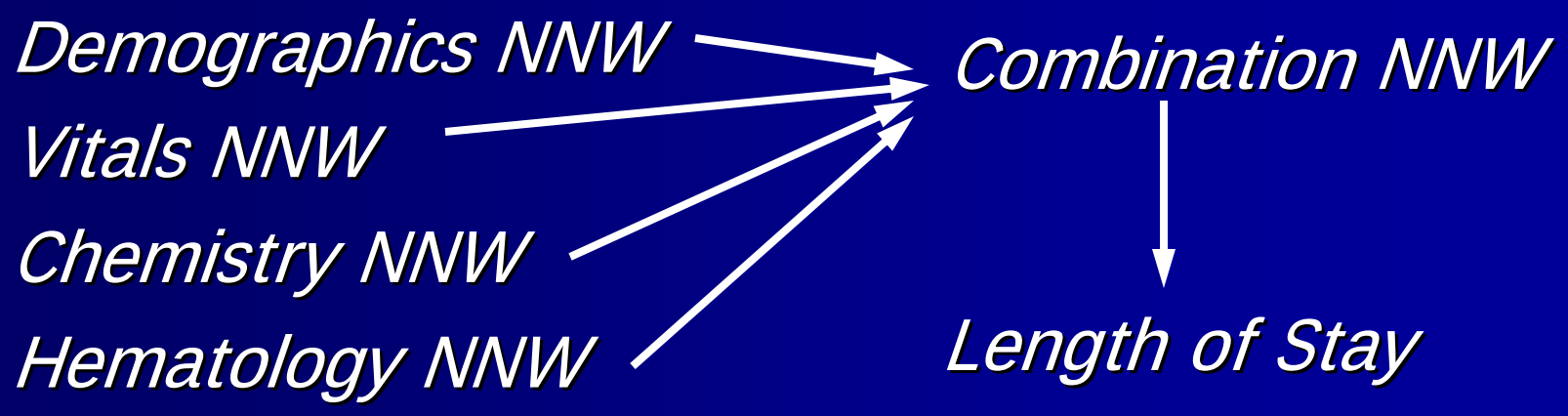
- Vitals
  - Ht, Wt, Pulse, BP, Resp, Pain Score
- Chemistry
  - Sodium, Potassium, Chloride, Bicarbonate Calcium, Urea, etc..
- Hematology
  - WBC, RBC, Platelets, Hg, MCV MCHC, etc..

Data gathering...

- *Analyzed Data from the past 5 years*
- *Selected Patients who has majority of these values*
- *Filtered by Labs & Vitals taken on the day or immediately before or after admission.*
- *Selected 2000 best representative patients...*

Our ANN Architecture

- *Single NNW*
  - *Not able to perform well*
- *Chain for NNW*



Gathering Data

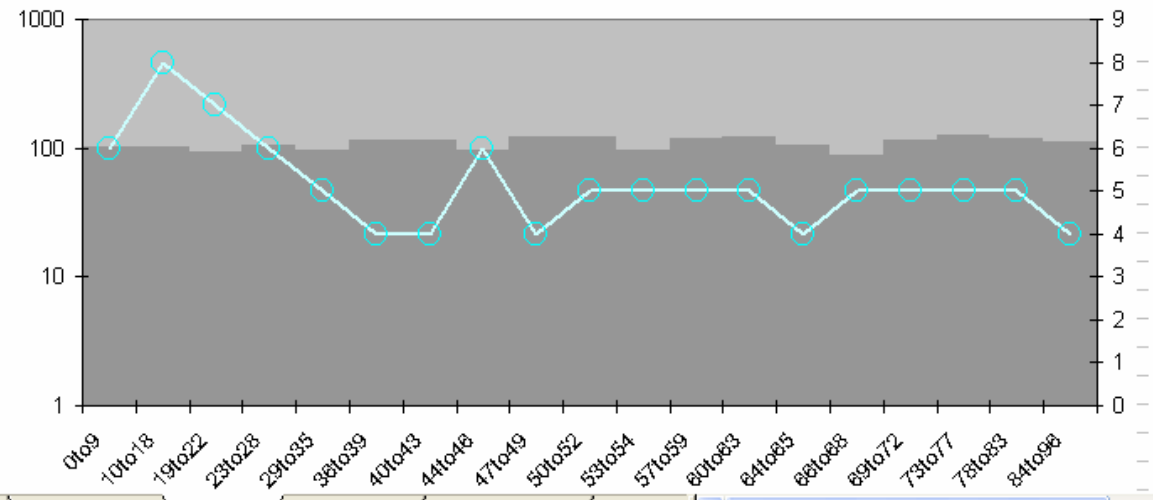
Microsoft Excel - CORRELATION4

code	LOS	CITY	RELIGION	ETHNICITY	GENDER	AGE
1	5	OTHER	NOT	WHITE	M	22
2	3	SANFORD	MET	WHITE	M	80
3	4	HILLSBOR	BAP	BLACK	M	66
4	3	BURLINGT	NOT	BLACK	F	55
5	3	CHAPEL	UNK	ASIAN	F	58
6	3	OTHER	NOT	BLACK	F	46
7	4	SANFORD	NOT	BLACK	F	59
8	8	CHAPEL	CHC	WHITE	M	33
9	4	CHAPEL	PRE	WHITE	F	88
10	3	CHAPEL	BAP	WHITE	F	94
11	4	OTHER	BLANK	WHITE	F	29
12	6	OTHER	BLANK	HISPN	F	26
13	7	OTHER	BAP	WHITE	M	36

Is there a correlation between any of these values and LOS?

Microsoft Excel - CORRELATION4

	CITY	RELIGION	ETHNICITY	GENDER	AGE
INCLUDES					
Total= 2141 Pts					



Experimental Design

- Training Set
- Validation Set
- Test Set
- Epoch
- Back propagation
- Hidden Nodes
- Minimize Mean Square Error

Training

LOS	50	250	1000	3000
16	12.3	15.47	15.983	16.002
6	7.0	5.57	5.947	6.001
7	7.8	5.24	6.910	7.006
7	7.7	6.72	6.977	7.001
7	7.2	6.48	7.139	7.005
2	5.3	4.91	2.250	2.015
7	5.9	5.08	6.900	7.004
5	5.6	3.95	4.962	5.001
23	14.5	22.36	23.012	23.008
3	6.7	3.91	3.284	3.013
5	10.6	6.24	4.981	5.011
4	8.1	4.27	3.983	4.003
4	2.6	4.51	4.088	4.011
7	5.4	4.27	7.053	7.006
5	10.3	4.36	5.028	5.005
7	10.9	5.79	6.970	7.007
4	10.5	5.18	3.917	4.007
4	6.2	4.28	3.994	4.006
10	7.0	10.98	9.902	10.007
7	12.5	7.36	7.043	7.012
22	21.2	21.66	22.005	22.022
2	8.4	4.81	2.266	2.001

		MSE		
	50	250	1000	3000
AVERAGE	3.535098	0.544377	0.032714	4.3642E-05
		DIFF		
AVERAGE	3.472	1.144	0.224	0
MEDIAN	3	1	0	0
MAX	19	5	2	0

There is a point at which the network should stop training

Results

	All		599pt
	LOS	Current	NN
Average=	7.6	4.5	8.0
Total=	4436	2607	4637

References/ Contact Details

- **References**
  - [1] Pofahl WE, Walczaks M, Rhone E, and Izenberg SD. Use of an artificial neural network to predict length of stay in acute pancreatitis. The American surgeon. 1998: 64: 868-872.
  - {2] Lowell WE and Davis GE. Predicting length of stay for psychiatric diagnosis-related groups using neural networks. J Am Med Inform Assoc. 1994: 1(6): 459–466.
  - [3] Tuj V, Gurrriere MRJ. Use of a neural network as a predictive instrument for length of stay in the intensive care unit following cardiac surgery. Symposium on computer applications in medical care (SCAMC) 1993: 26220-229.

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