

Translating Civilian and Defense Technologies for Pediatric Critical Care and Rehabilitation Research

Innovations in Informatics – Daniel J. Kocis Jr., Ph.D.

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ETL – Extract, Transformation, and Loading Clinical Data
How to optimize the rescaling of your data to minimize error
How to combine binary conditions that maximize *lift* and *size*

The current acronym of ETL (Extract Transform and Load) is focused on gathering all needed data from multiple sources. Past efforts moved a single sourced file into multiple tables with the advent of relational databases. The purpose was to allow for incremental build and updates without the overhead of complete reloads. The pendulum has swung back to a need for a single sourced master file. The main efforts in this presentation are to transform or create new and more meaningful variables from the raw information provided.

The art and science of mathematical investigation begins with asking, “What kind of data do I have? “, then “How do I re-represent these raw numbers into something more meaningful?” Datum refers to a single metric, usually a number while data are a collection of numbers and alpha-numerics. Before selecting a tool and building models, the investigator needs to create an extended database from which to calculate their models. Preliminary questions include:

Is it static (such as a one-time admission survey) or dynamic (periodic refreshing) data
Do they exist as a single table or spread across several tables
If they do exist across several tables, what is the hierarchy of each table?

This presentation addresses several issues and examples of creating-transforming raw variables into potential quantitative indicators and metric's.



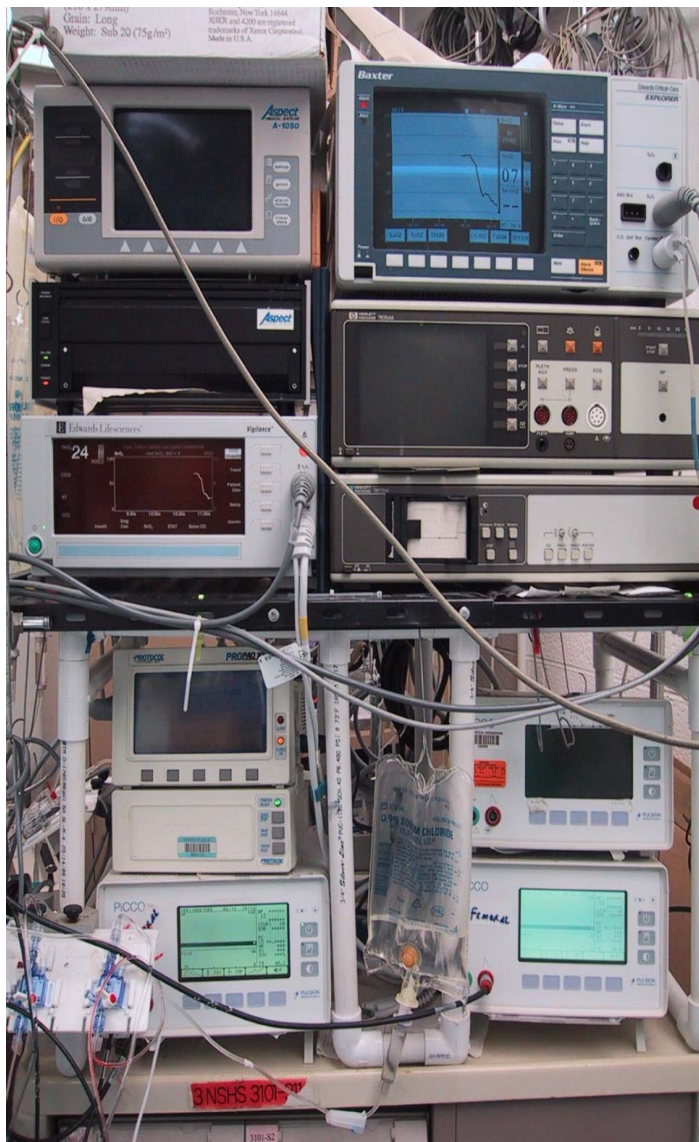
The most important and essential function of a pediatric intensive care unit (PICU) is to provide advanced monitoring capabilities to clinicians that evaluate the clinical status of patients and track their response to a wide range of interventions. Despite tremendous advancements in computerized medical technology, specifically signal processing and multivariate statistical data mining, critical care monitoring has not provided significantly new or improved information beyond the uni-dimensional vital signs and physiologic organ specific parameters available years ago.

The Pediatric Risk of Mortality Score (PRISM III) was developed and is very useful in predicting mortality in critically ill children but is based on single time dimensioned discrete physiologic and demographic data obtained at admission to the PICU, ignoring what happens to these parameters over time (variability) or after intervention.

Preliminary Data

Dr. Murray Pollack agreed to provide us with an updated version of the raw PRISM III database, encompassing 34,993 patients with an observed mortality rate of 3.57% equaling 1249 deaths (Pollack MM PK, Ruttimann UE. PRISM III: An updated pediatric risk of mortality score. *Crit Care Med* 1996; 16:743-752). There are a total of approximately 85 variables in the database. The dominant problem with these data are missing values or readings of physiologic variables not taken. It is not feasible to expect that each and every patient has been accessed on the entire battery of tests.

From a univariate perspective, we began the analysis by quantitatively finding ranges within each measure that reveal at least 50% increase in base mortality and then to identify this as a derogatory range for that variable. Missing data forms its own interval. The idea is to bin only those intervals with specific lift characteristics. If the data behaves monotonically, then cutoffs are established at either end of the distribution (high or low valued tails). Anyone beyond those cut points are coded as within the derogatory range. Note that the resultant (0,1) coding places all missing values *and* non-derogatory readings as zero with the coded value of 1 indicating problems.



The DISCRIM Procedure

Observations	2520	●	DF Total	2519
Variables	20		DF Within Classes	2518
Classes	2		DF Between Classes	1

Constant		-337.44258	-355.22260
H1SYSEBP	H1SysBP	0.30852	0.30111
H1DIASBP	H1DiasBP	0.14245	0.14450
H1HRTRAT	H1HrtRat	0.12342	0.13172
H1RSPRAT	H1RspRat	0.16184	0.17438
H1TEMP	H1Temp	3.05474	3.10327
H1PH	H1pH	-0.00458	-0.00395
H1PCO2	H1PCO2	0.11693	0.12795
H1NA	H1NA	2.91242	2.97024
H1K	H1K	5.71419	6.11595
H1CO2	H1CO2	0.85397	0.82685
H1BUN	H1BUN	-0.16999	-0.14899
H1CREAT	H1Creat	0.00184	0.00277
H1GLUC	H1Gluc	0.0001024	0.0003674
H1IONCA	H1IonCA	0.01449	0.00516
H1HEMGLB	H1HemGlb	0.18690	0.15600
H1WBCCNT	H1WBCCnt	0.0004904	0.0004272
H1PLATLT	H1PlatLt	0.0000348	0.0000382
N1PUP	N1Pup	-0.30782	4.31614
N1COMAST	N1ComaSt	5.50960	4.87282
N1GLASGW	N1Glasgw	-0.16163	-0.28265

Number of Observations and Percent Classified into RESP

From RESP	0	1	Total
0	2196 96.23	86 3.77	2282 100.00
1	93 39.08	145 60.92	238 100.00
Total	2289 90.83	231 9.17	2520 100.00
Priors	0.5	0.5	

* Requires full battery of test data

The tables below are univariate analyses of the most significant factors that have an increased predictive value at least 50% above the overall mortality rate of 3.57%. Variables 1-18 (*R1= recoded from the original data base: **COMAST**= coma level 1=coma,2=stupor; **GLASGW**= Glasgow coma score; **Pup**= 1 pupils, 2=unequal 3=nonreactive); **NA**= sodium; **CREAT**= creatinine; **DIASBP**= diastolic blood pressure; etc) in the ranges described under INTERVAL have mortality rates that vary from 21% to 6% as noted under RESPONSE RATE.*

The final table found below provides a rank ordering of significant intervals found within the data set. These intervals constitute the set of derogatory indicators, that by themselves, provide sizable lift from the base mortality rate. Combinatorial Decomposition (multivariate modeling), these will be test combinatorial interactions among selected variables seeking even greater lift from base. We provide two sets of outcome based upon this approach: 1.) includes those with non reactive pupils 2.) does not include those with non reactive pupils as non reactive pupils are highly suggestive of mortality. This assesses the effectiveness of a quantitative approach in a known ambiguous situation.

#	INTERVAL	NO.OF SOLICITED	NO.OF RESPONDERS	RESPONSE RATE	CHISQ	PROB.	RESPONSE INDEX
1	.	20887	609	2.916	24.998	0.0000	82 **
2	1 - 2	2212	467	21.112	1907.231	0.0000	591 *****>
3	3	3312	91	2.748	6.265	0.0123	77 **
4	4	8582	82	0.955	164.267	0.0000	27 *
		34993	1249	3.569	2102.761	0.0000	100

	TOTAL N	N	N MISSING	MEAN	STD.DEV.	MINIMUM	MAXIMUM	C.V.
ALL OBSERVATIONS	34993	14106	20887	3.37551397	0.92328585	1	4	27.35
NON-RESPONDERS	33744	13466	20278	3.45173028	0.84054006	1	4	24.35
RESPONDERS	1249	640	609	1.771875	1.10956416	1	4	62.62

	F	PROB>F	VARIANCES	T	DF	PROB> T
T TEST FOR COMPARING THE MEANS OF THE RESPONDERS AND NON-RESPONDERS	1.7426	0.0000	UNEQUAL EQUAL	37.7891 48.5887	674.3 14104.0	0.0000 0.0000

#	INTERVAL	NO.OF SOLICITED	NO.OF RESPONDERS	CONFIDENCE INTERVAL AT 95%		
				LEFT END	R.RATE	RIGHT END
1	.	20887	609	2.688	2.916	3.144 *
2	1 - 2	2212	467	19.411	21.112	22.813 *--
3	3	3312	91	2.191	2.748	3.304 *
4	4	8582	82	0.750	0.955	1.161 *
		34993	1249	3.375	3.569	3.764 O.R.R

#	INTERVAL	SOLICITATION PENETRATION		PENETRATION INDEX		RESPONSE PENETRATION	
		CUM.%	IND.%	INDEX	IND.%	CUM.%	
1	.	59.7	59.7	82	48.8	48.8	
2	1 - 2	66.0	6.3	591	37.4	86.1	
3	3	75.5	9.5	77	7.3	93.4	
4	4	100.0	24.5	27	6.6	100.0	

SINGLE FACTOR SCAN
 TYPE IS "CONTINUOUS"

N1GLASGW (N1Glasgw)

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#	INTERVAL	NO.OF SOLICITED	NO.OF RESPONDERS	RESPONSE RATE	CHISQ	PROB.	RESPONSE INDEX
1	.	17810	540	3.032	14.404	0.0001	85 ***
2	3 - 6	2075	487	23.470	2302.337	0.0000	658 *****>
3	7 - 10	2461	89	3.616	0.015	0.9015	101 ***
4	11 - 13	2861	33	1.153	46.781	0.0000	32 *
5	14	2200	36	1.636	23.029	0.0000	46 *
6	15	7586	64	0.844	157.893	0.0000	24 *
		34993	1249	3.569	2544.460	0.0000	100

	TOTAL N	N	N MISSING	MEAN	STD.DEV.	MINIMUM	MAXIMUM	C.V.
ALL OBSERVATIONS	34993	17183	17810	12.1923995	3.73338813	3	15	30.62
NON-RESPONDERS	33744	16474	17270	12.4579944	3.46738962	3	15	27.83
RESPONDERS	1249	709	540	6.02115656	4.32942283	3	15	71.90

	F	PROB>F	VARIANCES	T	DF	PROB> T
T TEST FOR COMPARING THE MEANS OF THE RESPONDERS AND NON-RESPONDERS	1.5590	0.0000	UNEQUAL EQUAL	39.0528 47.8517	747.6 17181.0	0.0000 0.0000

#	INTERVAL	NO.OF SOLICITED	NO.OF RESPONDERS	CONFIDENCE INTERVAL AT 95%		
				LEFT END	R.RATE	RIGHT END
1	.	17810	540	2.780	3.032	3.284 *
2	3 - 6	2075	487	21.646	23.470	25.293 --*
3	7 - 10	2461	89	2.879	3.616	4.354 *
4	11 - 13	2861	33	0.762	1.153	1.545 *
5	14	2200	36	1.106	1.636	2.167 *
6	15	7586	64	0.638	0.844	1.049 *
		34993	1249	3.375	3.569	3.764 O.R.R

□

#	INTERVAL	NO.OF SOLICITED	NO.OF RESPONDERS	RESPONSE RATE	CHISQ	PROB.	RESPONSE INDEX
1	.	14769	250	1.693	145.710	0.0000	47 *
2	1.220000029 - 94	2269	95	4.187	2.425	0.1194	117 ****
3	94.59999847 - 110	2348	58	2.470	7.947	0.0048	69 **
4	111 - 125	2257	60	2.658	5.247	0.0220	74 **
5	125.4000015 - 141	2274	82	3.606	0.009	0.9262	101 ***
6	141.8999939 - 160	2294	77	3.357	0.291	0.5897	94 ***
7	160.3300018 - 184	2287	77	3.367	0.263	0.6084	94 ***
8	184.8000031 - 223	2252	106	4.707	8.166	0.0043	132 *****
9	223.3000031 - 302.5	2251	181	8.041	126.101	0.0000	225 *****
10	303 - 11259.23047	1992	263	13.203	517.939	0.0000	370 *****
		34993	1249	3.569	814.096	0.0000	100

	TOTAL N	N	N MISSING	MEAN	STD.DEV.	MINIMUM	MAXIMUM	C.V.
ALL OBSERVATIONS	34993	20224	14769	212.629548	403.293381	1.22000003	11259.2305	189.67
NON-RESPONDERS	33744	19225	14519	209.041254	398.735373	1.22000003	11259.2305	190.74
RESPONDERS	1249	999	250	281.683554	477.70742	3	6395.24023	169.59

	F	PROB>F	VARIANCES	T	DF	PROB> T
T TEST FOR COMPARING THE MEANS OF THE RESPONDERS AND NON-RESPONDERS	1.4353	0.0000	UNEQUAL EQUAL	-4.7216 -5.5548	1071.5 20222.0	0.0000 0.0000

#	INTERVAL	NO.OF SOLICITED	NO.OF RESPONDERS	CONFIDENCE INTERVAL AT 95%		
				LEFT END	R.RATE	RIGHT END
1	.	14769	250	1.485	1.693	1.901 *
2	1.220000029 - 94	2269	95	3.363	4.187	5.011 -*
3	94.59999847 - 110	2348	58	1.842	2.470	3.098 -*
4	111 - 125	2257	60	1.995	2.658	3.322 *
5	125.4000015 - 141	2274	82	2.840	3.606	4.372 -*
6	141.8999939 - 160	2294	77	2.620	3.357	4.094 *
7	160.3300018 - 184	2287	77	2.628	3.367	4.106 *
8	184.8000031 - 223	2252	106	3.832	4.707	5.582 -*
9	223.3000031 - 302.5	2251	181	6.918	8.041	9.164 -*
10	303 - 11259.23047	1992	263	11.716	13.203	14.689 -*
		34993	1249	3.375	3.569	3.764 O.R.R

#	INTERVAL	NO.OF SOLICITED	NO.OF RESPONDERS	RESPONSE RATE	CHISQ	PROB.	RESPONSE INDEX
1	.	11696	161	1.377	157.555	0.0000	39 *
2	1.399999976 - 135	2799	124	4.430	5.812	0.0159	124 ****
3	135.1999969 - 137	2909	80	2.750	5.469	0.0194	77 **
4	137.5 - 139	4077	84	2.060	26.008	0.0000	58 *
5	139.8999939 - 141	4012	112	2.792	6.798	0.0091	78 **
6	141.1999969 - 143	3324	101	3.039	2.624	0.1053	85 **
7	143.1999969 - 146	3051	147	4.818	13.331	0.0003	135 ****
8	146.1000061 - 155	2615	269	10.287	330.604	0.0000	288 *****
9	155.1000061 - 512	510	171	33.529	1282.556	0.0000	939 *****>
		34993	1249	3.569	1830.756	0.0000	100

	TOTAL N	N	N MISSING	MEAN	STD.DEV.	MINIMUM	MAXIMUM	C.V.
ALL OBSERVATIONS	34993	23297	11696	141.076492	7.24706376	1.39999998	512	5.14
NON-RESPONDERS	33744	22209	11535	140.823438	6.91018668	1.39999998	512	4.91
RESPONDERS	1249	1088	161	146.242004	11.0449658	119	215	7.55

	F	PROB>F	VARIANCES	T	DF	PROB> T
T TEST FOR COMPARING THE MEANS OF THE RESPONDERS AND NON-RESPONDERS	2.5548	0.0000	UNEQUAL EQUAL	-16.0291 -24.3846	1129.1 23295.0	0.0000 0.0000

#	INTERVAL	NO.OF SOLICITED	NO.OF RESPONDERS	CONFIDENCE INTERVAL AT 95%		
				LEFT END	R.RATE	RIGHT END
1	.	11696	161	1.165	1.377	1.588 *
2	1.399999976 - 135	2799	124	3.668	4.430	5.192 *
3	135.1999969 - 137	2909	80	2.156	2.750	3.344 *
4	137.5 - 139	4077	84	1.624	2.060	2.496 *
5	139.8999939 - 141	4012	112	2.282	2.792	3.301 *
6	141.1999969 - 143	3324	101	2.455	3.039	3.622 *
7	143.1999969 - 146	3051	147	4.058	4.818	5.578 *
8	146.1000061 - 155	2615	269	9.122	10.287	11.451 *
9	155.1000061 - 512	510	171	29.432	33.529	37.627 --*---
		34993	1249	3.375	3.569	3.764 O.R.R

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V3.2

ALL POSSIBLE SEGMENTS OF PROJECT FIRST, SORTED BY RESPONSE INDEX, DETERMINED BY VARIABLES

R1CREAT R1DIASBP R1GLASGW R1GLUC R1HRTRAT R1NA R1PCO2 R1PLATLT R1PUP

CONDITIONS ARE CONFIDENCE LEVEL=95%, LIFT=100%, MINIMUM NUMBER OF SOLICITED=1, MINIMUM NUMBER OF RESPONDERS=200

TOTAL NUMBER OF SOLICITED=34,993, TOTAL NUMBER OF RESPONDERS=1,249, OVERALL RESPONSE RATE=3.57%

#	NO.OF SOLICITED	NO.OF RESPONDERS	RESPONSE INDEX	RESPONSE RATE (%)	CONF. INTERVAL LEFT - RIGHT	DESCRIPTION OF SEGMENT
1	303	219	2025	72.28	67.24 - 77.32	R1GLUC=h1gluc gt 223.3 R1PUP=nlpup gt 2
2	323	229	1986	70.90	65.94 - 75.85	R1NA=h1na gt 146.1 R1PUP=nlpup gt 2
3	293	205	1960	69.97	64.72 - 75.21	R1NA=h1na gt 146.1 R1PLATLT=Other R1PUP=nlpup gt 2
4	521	333	1791	63.92	59.79 - 68.04	R1GLASGW=nlglasgw ge 3 to le 6 R1PUP=nlpup gt 2
5	474	294	1738	62.03	57.66 - 66.39	R1GLASGW=nlglasgw ge 3 to le 6 R1PLATLT=Other R1PUP=nlpup gt 2
6	448	274	1714	61.16	56.65 - 65.67	R1DIASBP=Other R1GLASGW=nlglasgw ge 3 to le 6 R1PUP=nlpup gt 2
7	427	261	1713	61.12	56.50 - 65.75	R1GLASGW=nlglasgw ge 3 to le 6 R1PCO2=Other R1PUP=nlpup gt 2
8	431	260	1690	60.32	55.71 - 64.94	R1GLASGW=nlglasgw ge 3 to le 6 R1HRTRAT=Other R1PUP=nlpup gt 2
9	393	234	1668	59.54	54.69 - 64.39	R1GLASGW=nlglasgw ge 3 to le 6 R1PCO2=Other R1PLATLT=Other R1PUP=nlpup gt 2
10	405	239	1653	59.01	54.22 - 63.80	R1DIASBP=Other R1GLASGW=nlglasgw ge 3 to le 6 R1PLATLT=Other R1PUP=nlpup gt 2
11	406	238	1642	58.62	53.83 - 63.41	R1CREAT=Other R1GLASGW=nlglasgw ge 3 to le 6 R1PUP=nlpup gt 2
12	392	228	1630	58.16	53.28 - 63.05	R1GLASGW=nlglasgw ge 3 to le 6 R1HRTRAT=Other R1PLATLT=Other R1PUP=nlpup gt 2
13	368	213	1622	57.88	52.84 - 62.93	R1DIASBP=Other R1GLASGW=nlglasgw ge 3 to le 6 R1PCO2=Other R1PUP=nlpup gt 2
14	362	209	1618	57.73	52.65 - 62.82	R1GLASGW=nlglasgw ge 3 to le 6 R1HRTRAT=Other R1PCO2=Other R1PUP=nlpup gt 2

QTMS
V3.2
INTERVALS OF PROJECT FIRST THAT HAVE RESPONSE RATES SIGNIFICANTLY HIGHER OR LOWER
(WITH 95% CONFIDENCE) THAN THE OVERALL RESPONSE RATE +- 50%

VARIABLE	INTERVAL	NO. OF SOLICITED	NO. OF RESPS.	RESPONSE RATE	RESPONSE INDEX	INDEX OF THE 95% CONFIDENCE INTERVAL'S CLOSEST POINT TO THE OVERALL RESPONSE RATE
R1COMAST	equals 1 or 2	2212	467	21.112	591	544
R1GLASGW	nlglasgw ge 3 to le 8	3133	528	16.853	472	435
R1PUP	nlpup eq 2	121	25	20.661	579	377
R1NA	hlna gt 146.1	3125	440	14.080	394	360
R1CREAT	hlcreat gt .89	2651	364	13.731	385	348
R1DIASBP	hldiasbp ge 101	1005	123	12.239	343	286
R1GLUC	hlgluc gt 223.3	4243	444	10.464	293	267
R1PLATLT	hplatlt ge -68 to le 100	2288	240	10.490	294	259
R1PCO2	hlpc2 gt 50	4643	447	9.627	270	246
R1HEMGLB	gt 15.8	1410	136	9.645	270	227
R1IONCA	le 4.5 or gt 5.39	4863	408	8.390	235	213
R1K	gt 5	4217	351	8.323	233	210
R1BUN	ge 12	8497	654	7.697	216	200
R1CO2	lt 18 or ge 29	5191	408	7.860	220	200
R1SYSBP	lt 99 or gt 158	6145	434	7.063	198	180
R1RSPRAT	ge 73	1565	112	7.157	201	165
R1TEMP	lt 36.7 or ge 38.8	7422	469	6.319	177	162
R1WBCCNT	le 3 or gt 15	7135	436	6.111	171	156

QTMS
V3.2
ALL POSSIBLE SEGMENTS OF PROJECT FIRST, SORTED BY RESPONSE INDEX, DETERMINED BY VARIABLES
R1BUN R1CO2 R1COMAST R1CREAT R1GLASGW R1GLUC R1HEMGLB R1IONCA R1K R1NA R1PLATLT R1PUP R1WBCCNT
CONDITIONS ARE CONFIDENCE LEVEL=95%, LIFT=100%, MINIMUM NUMBER OF SOLICITED=1, MINIMUM NUMBER OF RESPONDERS=200
TOTAL NUMBER OF SOLICITED=34,993, TOTAL NUMBER OF RESPONDERS=1,249, OVERALL RESPONSE RATE=3.57%

#	NO. OF SOLICITED	NO. OF RESPONDERS	RESPONSE INDEX	RESPONSE RATE (%)	CONF. INTERVAL LEFT - RIGHT	DESCRIPTION OF SEGMENT
1	403	205	1425	50.87	45.99 - 55.75	R1COMAST>equals 1 or 2 R1GLASGW=nlglasgw ge 3 to le 8 R1GLUC=hlgluc gt 223.3
2	460	226	1376	49.13	44.56 - 53.70	R1COMAST>equals 1 or 2 R1NA=hlna gt 146.1
3	443	217	1372	48.98	44.33 - 53.64	R1COMAST>equals 1 or 2 R1NA=hlna gt 146.1 R1PUP=Other
4	432	210	1362	48.61	43.90 - 53.32	R1COMAST>equals 1 or 2 R1HEMGLB=Other R1NA=hlna gt 146.1
5	417	202	1357	48.44	43.64 - 53.24	R1COMAST>equals 1 or 2 R1HEMGLB=Other R1NA=hlna gt 146.1 R1PUP=Other

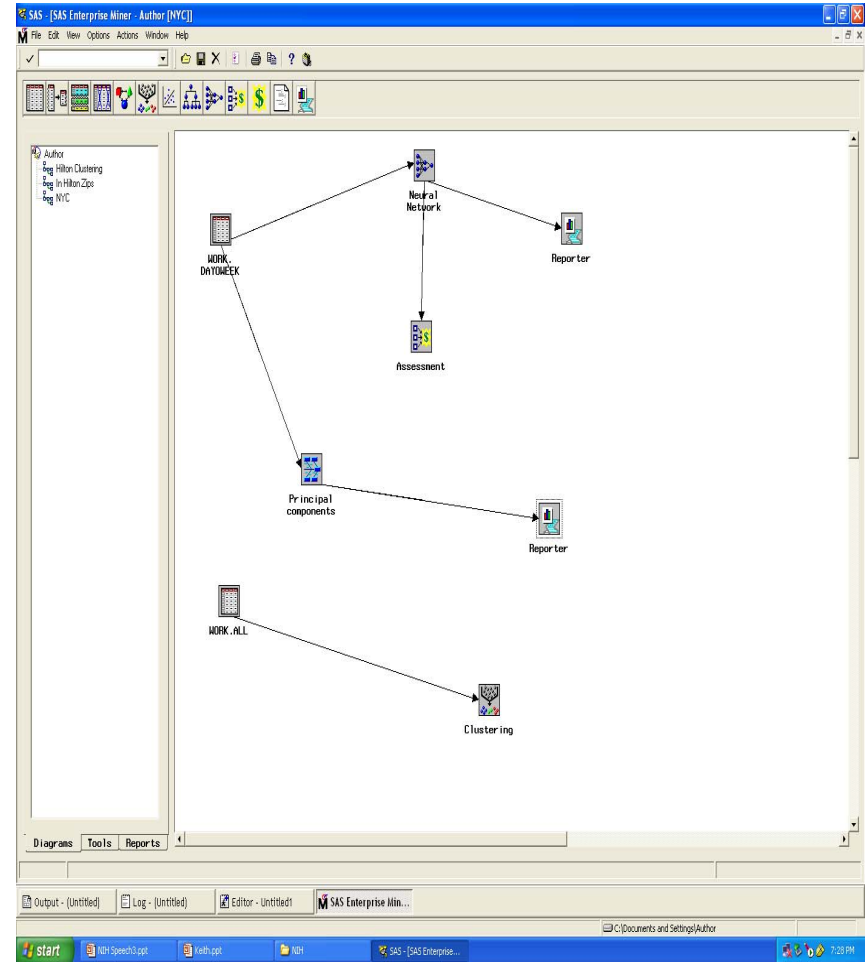
QIMS
V3.2

ALL POSSIBLE SEGMENTS OF PROJECT FIRST, SORTED BY RESPONSE INDEX, DETERMINED BY VARIABLES
 R1BUN R1CO2 R1COMAST R1CREAT R1GLASGW R1GLUC R1HEMGLB R1IONCA R1K R1NA R1PLATLT R1PUP R1WBCCNT
 CONDITIONS ARE CONFIDENCE LEVEL=95%, LIPT=100%, MINIMUM NUMBER OF SOLICITED=1, MINIMUM NUMBER OF RESPONDERS=200
 TOTAL NUMBER OF SOLICITED=34,993, TOTAL NUMBER OF RESPONDERS=1,249, OVERALL RESPONSE RATE=3.57%

#	NO.OF SOLICITED	NO.OF RESPONDERS	RESPONSE INDEX	RESPONSE RATE(%)	CONF. INTERVAL LEFT - RIGHT	DESCRIPTION OF SEGMENT
1	403	205	1425	50.87	45.99 - 55.75	R1COMAST=equals 1 or 2 R1GLUC=h1gluc gt 223.3 R1GLASGW=h1glasgw ge 3 to le 8
2	460	226	1376	49.13	44.56 - 53.70	R1COMAST=equals 1 or 2 R1NA=h1na gt 146.1
3	443	217	1372	48.98	44.33 - 53.64	R1COMAST=equals 1 or 2 R1PUP=Other R1NA=h1na gt 146.1
4	432	210	1362	48.61	43.90 - 53.32	R1COMAST=equals 1 or 2 R1NA=h1na gt 146.1 R1HEMGLB=Other
5	417	202	1357	48.44	43.64 - 53.24	R1COMAST=equals 1 or 2 R1NA=h1na gt 146.1 R1HEMGLB=Other R1PUP=Other
6	497	238	1342	47.89	43.50 - 52.28	R1COMAST=equals 1 or 2 R1PUP=Other R1GLUC=h1gluc gt 223.3
7	515	246	1338	47.77	43.45 - 52.08	R1COMAST=equals 1 or 2 R1GLUC=h1gluc gt 223.3
8	429	204	1332	47.55	42.83 - 52.28	R1COMAST=equals 1 or 2 R1PLATLT=Other R1NA=h1na gt 146.1
9	477	225	1322	47.17	42.69 - 51.65	R1COMAST=equals 1 or 2 R1HEMGLB=Other R1GLUC=h1gluc gt 223.3 R1PUP=Other
10	494	233	1321	47.17	42.76 - 51.57	R1COMAST=equals 1 or 2 R1HEMGLB=Other R1GLUC=h1gluc gt 223.3
11	462	216	1310	46.75	42.20 - 51.30	R1COMAST=equals 1 or 2 R1PLATLT=Other R1GLUC=h1gluc gt 223.3 R1PUP=Other
12	477	222	1304	46.54	42.06 - 51.02	R1COMAST=equals 1 or 2 R1PLATLT=Other R1GLUC=h1gluc gt 223.3
13	444	205	1294	46.17	41.53 - 50.81	R1COMAST=equals 1 or 2 R1HEMGLB=Other R1PUP=Other R1GLUC=h1gluc gt 223.3 R1PLATLT=Other

Summary : Using QTMS and SAS 9.x

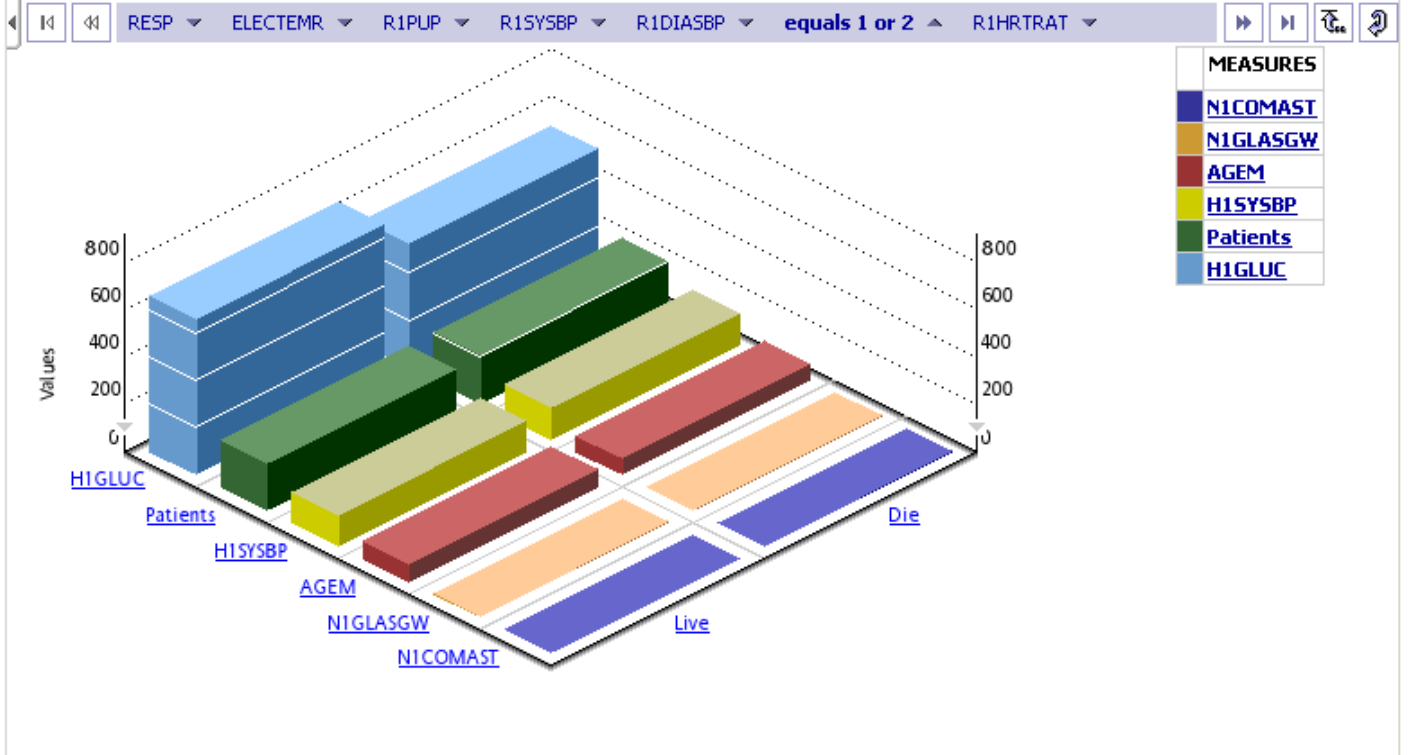
- Each raw variable has a range of values including missing or not available
- Single Factor Scans, group the distribution into intervals
- Single Factor Summary, ID all intervals with specific lift
- Recode ID'd intervals as (1,0)
- N-way Combinatorial Decomposition based upon *size* and *lift*
- Use standard statistics : factor analysis, logistic and discriminate analysis
- ID and segment the multivariate interactive effects from simple linear ones



Real Time Risk Of Mortality and INstability : Bone's Tricorder?



- cdiFinal1
 - RESPI
 - ELECTEMR
 - R1PUP
 - R1SYSBP
 - R1DIASBP
 - R1COMAST
 - Other
 - equals 1 or 2
 - R1HRTRAT
 - R1GLASGW
 - Other
 - n1glasgw ge 3 to le 8
 - R1RSPRAT
 - R1TEMP
 - R1PH
 - R1PLATLT
 - R1PCO2
 - R1NA
 - R1K
 - R1CO2
 - R1HEMGLB
 - R1WBCCNT
 - R1BUN
 - R1IONCA
 - R1CREAT
 - R1GLUC
 - Other
 - h1gluc gt 223.3
 - MEASURES



MEASURES as values	Live	Die
NICOMAST	1,374	1,044
N1GLASGW	5	3
AGEM	76	69
H1SYSBP	130	133
Patients	198	205
H1GLUC	660	528

Once Critical conditions are established, continuous monitoring in real-time can alert a physician via v-mail or e-mail.

What's next...**REALTROMINS**

The overall hypothesis of this example is to integrate and analyze multiple, clinically important and diverse variables using:

- * real time continuous physiologic organ specific parameters (i.e. heart rate),
- * with advanced statistical measures of the variability of these parameters,
- coupled with intermittent organ specific physiologic data important in predicting mortality,
- and known demographic predictors of mortality.

In summary we are using advanced signal processing, statistical, data fusion, and mining techniques to create a real time, continuous, composite index of risk for mortality and/or instability (**REALTROMINS- ReaTime Risk Of Mortality and INStability) in critically ill children (NIH Grant 1 R41 HD047687-01 Multivariate Algorithms Inc 2005)**

Other physiologic indicators will also be used creatively by finding specific ranges of values that are statistically deemed as derogatory. A patients predicted outcome maybe effected when the observed bad ranges are seen singularly or in combinations.

GOAL

The successful completion of this project will result in new, advanced critical care monitoring technology that provides the bedside clinicians with real time continuous assessment of the status of critically ill children and helps guide the medical interventions necessary to return these children back to health.

SPECIFIC AIMS

Establish a database of continuous, intermittent, and discrete physiologic parameters which are important in predicting mortality in critically ill children

Filter signal from noise in the continuous physiologic monitoring parameters using advanced signal processing techniques.

Calculate standard and novel, time and frequency domain indices of variability of the continuous physiologic monitoring parameters using advanced statistical techniques

***Measure what is measurable and render that which is not
...Galileo***

