



Advancing IT Capacity Planning capabilities using neural networks

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This is a presentation of a business proposition.

We make no pretensions of particular expertise in neural network science, and are not recommending any specific methodology or approach. Instead, we hope to provide some insight into one practical use of the NeuralTools package and perhaps encourage you to look at the business applications possible in your organization.



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Who we are and what we do

- **Fiserv Investment Services provides “back room” processing of investment activity for 90% of all investment banks and brokerage houses.**
- **Special portfolio management software provides funds managers with tools necessary in optimizing returns.**
- **Inter-day trade analysis tools help managers react quickly to evolving market conditions**
- **Instant market analysis reporting provides the most reliable source of investment analytic data.**

How we do that

- **Data centers in multiple locations provide continuous access to the analytical engines.**
- **Massive overnight work flows update millions of portfolios with daily activity.**
- **Overnight analytical runs provide investment planners with start-of-day guidance.**
- **Real-time guidance is provided through portfolio model evaluations against current market statistics.**

What it takes

- **Redundant computer facilities always available**
 - Data centers in diverse geographical areas provide fail-safe service.
 - Multi-host networks provide alternative communications paths.
 - Disaster recovery sites provide recoverability in the event of catastrophic failure.
- **Processing power and support services must be available for all client requests**
 - Data center sizing has to accommodate “peak loads”.
 - Recovery sites have to accommodate normal operations plus anticipated catch-up volumes.
 - Operations and support staff must exist to support all hardware deployments.

What it takes

- **Hundreds of mid-range and high-end servers to support client interfaces.**
- **Large mainframe centers to process bulk data.**
- **Multiple communications and interface platforms to accommodate the disparate client system feeds.**
- **\$500M+ annual budget for hardware, software, support.**



Problem definitions

Our task as Enterprise Systems Assurance

■ **Control costs**

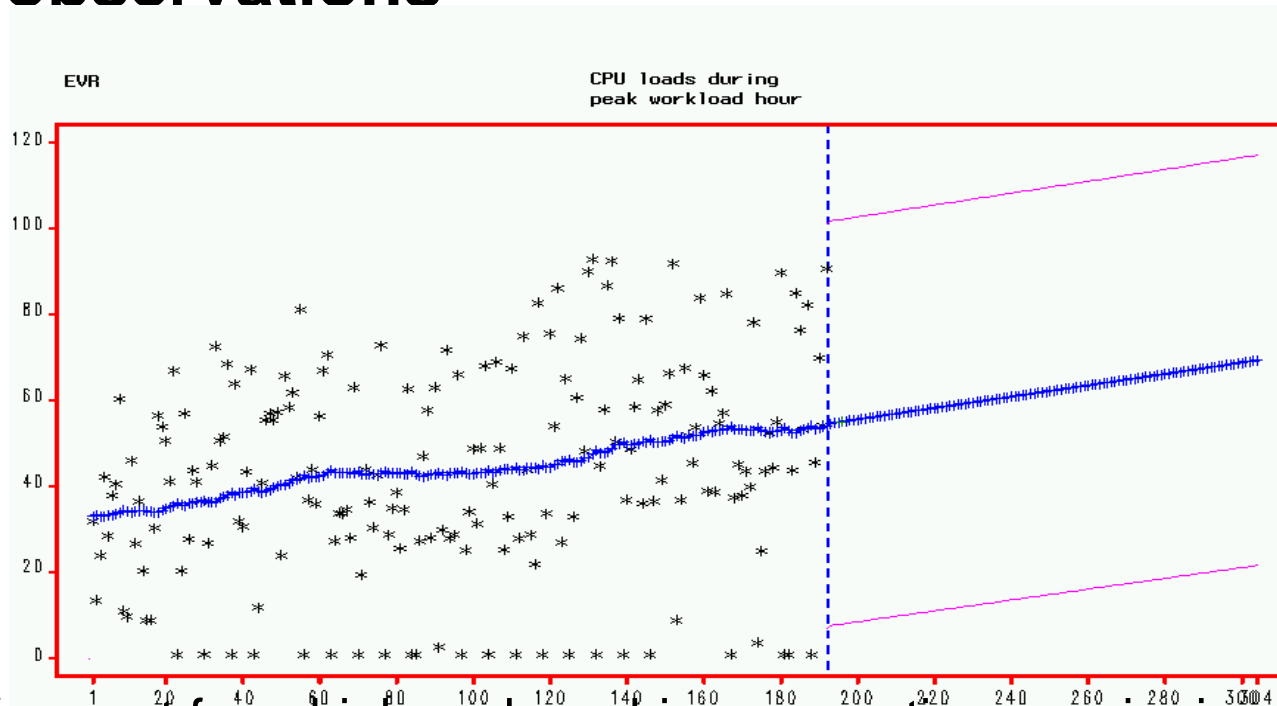
- Ensure quality with minimum investment
- Identify optimum configurations and solutions that meet long-term requirements
- Hold support cost growth to a minimum

■ **Ensure service levels**

- Design and deploy systems that will not fail under unusual situations
- Anticipate client and markets evolutions and plan for events
- Manage machine and human resources to ensure adequate service

Traditionally we used historical data analysis

- Capacity planners, and planning software, projected the future based on past observations



Capacity forecast for a high-end machine supporting a major investment bank

Traditional approaches fall short

- **Supporting the investment services industry in today's economic environment is a challenge**
 - Market instability drives unusual activity
 - Market volumes become unpredictable
 - Client activity patterns change frequently
 - Mergers and acquisitions change requirements
- **Providing uninterrupted system services becomes excessively costly**
 - Unpredictable demand requires massive over-sizing of infrastructures
 - Declines in service availability drive up support costs
 - Expanding to accommodate acquisitions is always out-of-budget and distorts financial results



Moving into an NN world

New approaches

As previously noted, traditional planning approaches trend historical data. Basically, there are two possible approaches...

- 1. Use standard statistical analysis tools to forecast future requirements.*
- 2. Identify peak loads and size the infrastructure to accommodate those peaks.*

that result in two problematic planning scenarios...

- 1. “midline” forecasts result in under-deployment of resources during times of stress and unusual activity.*
- 2. “peak” forecasts result in expenditures for equipment that is largely idle for extended periods.*

New approaches

Advantages in leveraging the Neural Network concept

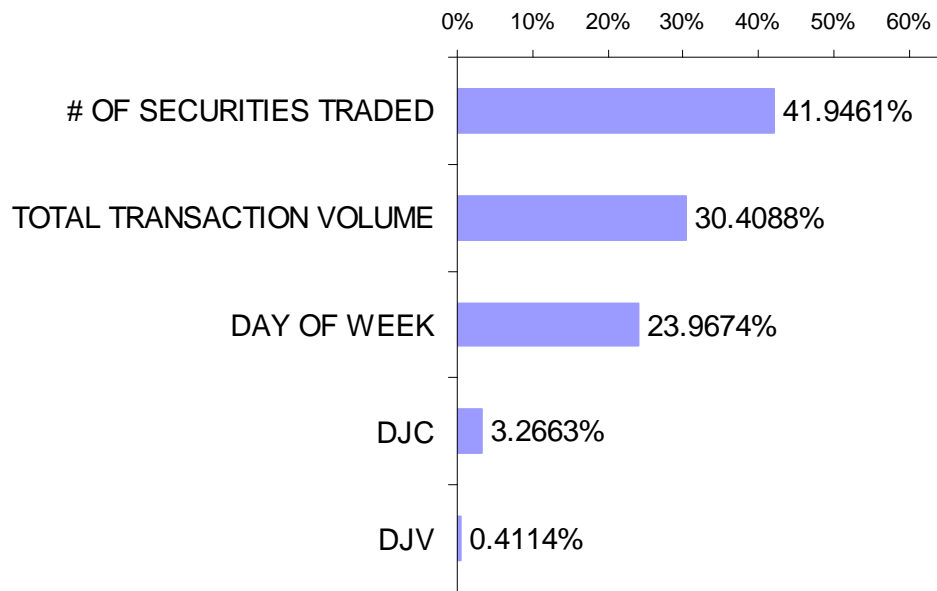
1. One primary advantage we've recognized is the ability to analyze many independent variables in relation to primary dependents, replacing the need for extensive correlation research by analysts.
 - a) Over seventy external metrics impact our activity level, ranging from security trade volume by broker to euro-dollar volatility.
 - b) Twenty-four identified business metrics contribute to future requirements, including client growth expectations in several areas, merger/acquisition expectations and impacts, and historical growth metrics.
 - c) Over one hundred IT system metrics are in play, ranging from individual machine utilization to network saturation between facilities.

New approaches

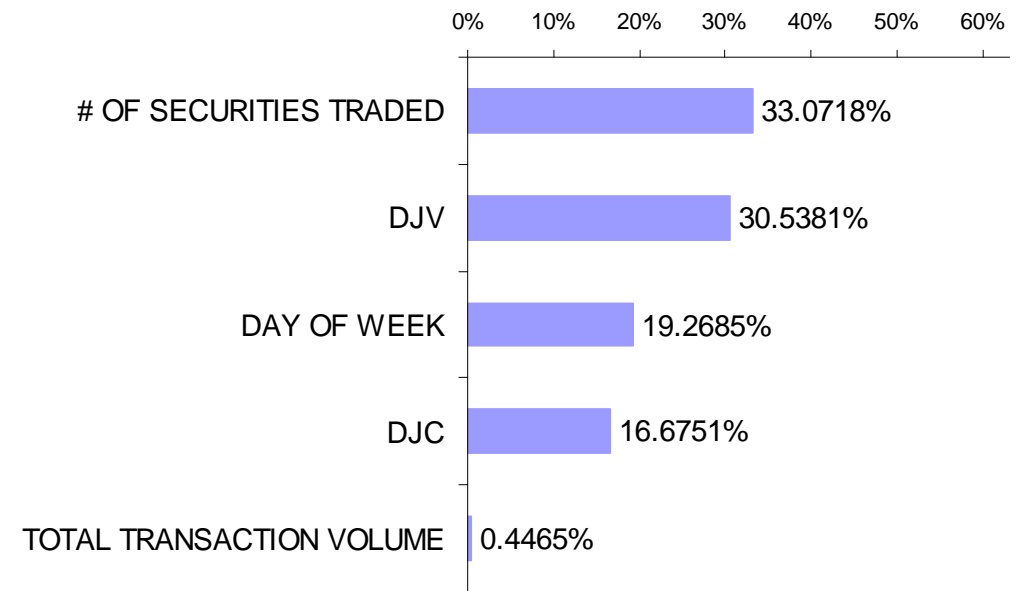
Advantages in leveraging the Neural Network concept

2. Evolving trends and correlations are recognized by the net without having to re-execute massive analytical efforts.

Relative Variable Impacts



Relative Variable Impacts



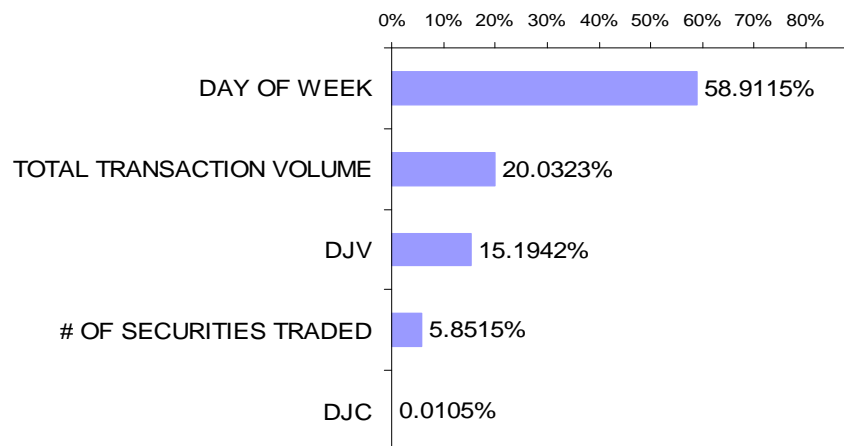
Variable impact before / after the October market collapse

New approaches

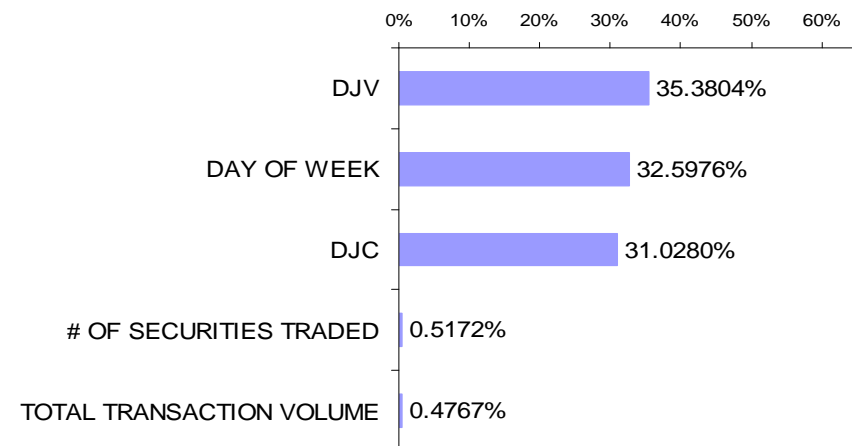
Advantages in leveraging the Neural Network concept

3. Emerging conditions can be readily accommodated within the net, as opposed to the extensive rework required to incorporate new information in a traditional statistical analysis model.

Relative Variable Impacts



Relative Variable Impacts



Variable impact before / after sub-prime bank failures



What has NeuralTools done for us?

Reduced costs and improved service levels

- **Changed from peak-load growth to capacity on demand**
- **Provided early-warning capabilities to allow operations to manage workloads with less staff**
- **Reduced staffing requirements for both business and infrastructure support services**
- **Improved client service levels through use of advanced technology possible due to reduced operational costs**

Variable impact before / after sub-prime bank failures

Reduced costs and improved service levels

Changed from peak-load growth to capacity on demand, reducing total operational costs by 29%

															Peak load															
															Machine	type	processors	speed	rperf	memory	days	hour	peak							
																	24	2.3		192	FB	8.15	137.7%							
															Projected growth monthly			Special events												
															2008	2009	2010	2008	2009	2010										
															0.9%	1.4%	1.2%	0.0%	81.0%	0.0%										
															Processors required under current hardware/os			Processors required for AIX 6.1 *****			Processors required for AIX 6.1 *****			Requirements with COD capability on **/6.1 *****						
															2008	2009	2010	2008	2009	2010	2008	2009	2010	2008		2009		2010		
																									active	reserve	active	reserve	active	reserve
															17	34	38	12	29	33	10	20	23	7	3	12	7	15	8	
Purchase cost	\$714,366	\$1,397,634	\$1,581,489	\$516,563	\$1,211,412	\$1,370,770	\$703,973	\$1,377,300	\$1,558,480	\$511,122	\$15,068	\$825,000	\$16,073	\$1,031,250	\$18,082															
Annual maintenance	\$85,724	\$167,716	\$189,779	\$61,988	\$145,369	\$164,492	\$84,477	\$165,276	\$187,018	\$61,335	0	\$99,000	0	\$123,750	0															
Operational cost	\$30,000	\$45,000	\$45,000	\$15,000	\$30,000	\$45,000	\$15,000	\$30,000	\$30,000	\$15,000	\$2,500	\$15,000	\$2,667	\$15,000	\$3,000															
Total cost	\$830,107	\$1,610,384	\$1,816,306	\$593,563	\$1,386,811	\$1,580,295	\$803,459	\$1,572,596	\$1,775,520	\$587,464	\$17,571	\$939,012	\$18,747	\$1,170,015	\$21,090															
			\$4,256,797			\$3,560,669			\$4,151,576					\$2,753,899																

Three-year operational savings of \$1.3 million

Reduced costs and improved service levels

Reduced staffing requirements due to less hardware, fewer incidents to manage.

	per server	total servers	per COD	COD/year	total	Staff saved
Chicago operations staff	0.0625	145	0	0	9	
	0.0625	98	0.000174	3234	7	2.38
central planning	0.033	145	0	0	5	
	0.033	98	0.000001	3234	3	1.55
engineering	0.033	145			5	
	0.033	98			3	1.55
Command center	0.0133	420	0	0	6	
	0.0133	275	0	7692	4	1.92
Total headcount savings						7.40
average annual cost	\$138,474					\$1,024,100

Three-year operational savings of \$3.07 million



Thank You

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