General Lessons we can Learn from Black Box Trading

+ How to avoid fooling yourself when searching for an investment edge

John Elder, Ph.D.

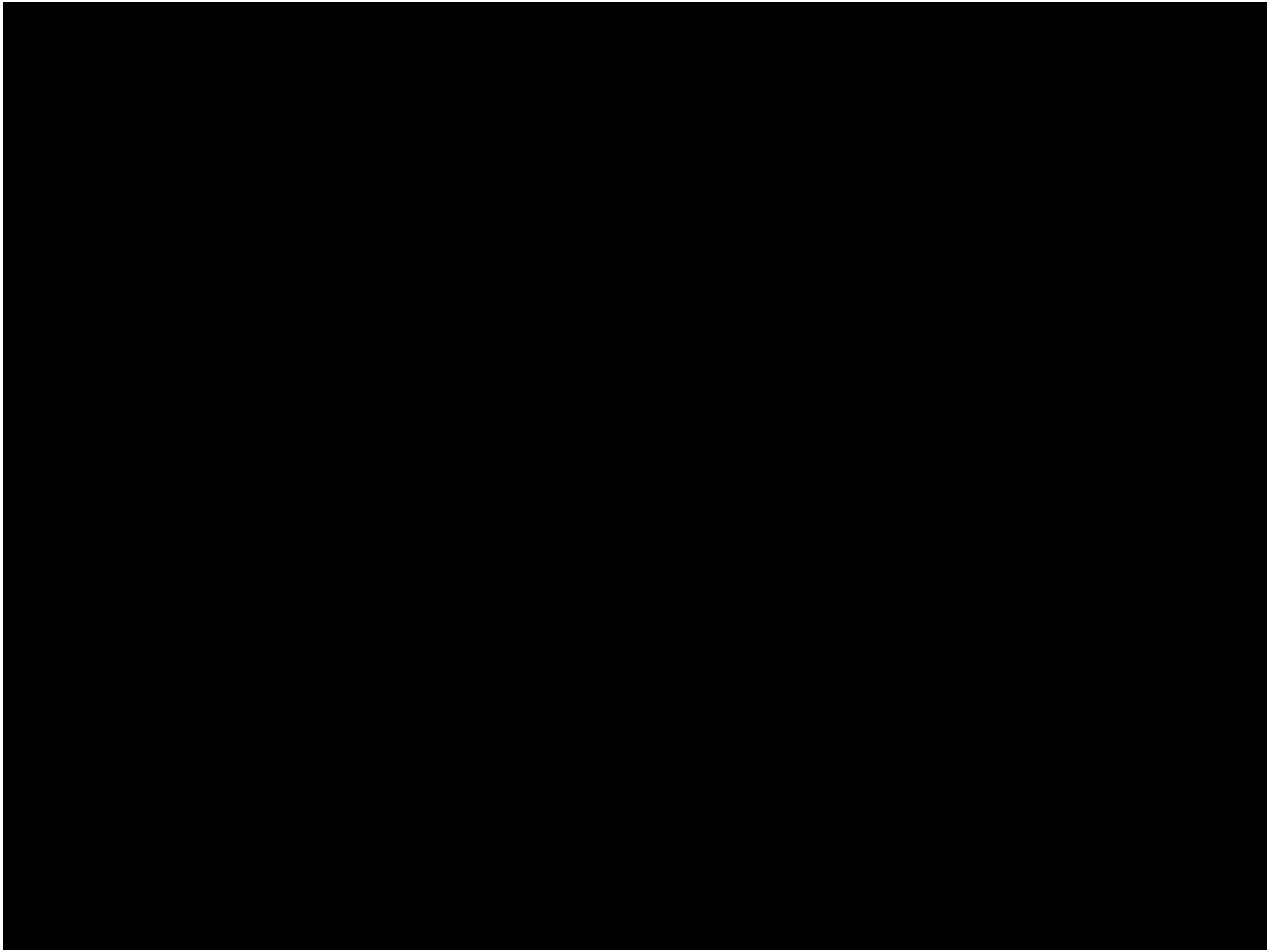
elder@datamininglab.com

@johnelder4

ELDER RESEARCH INC.

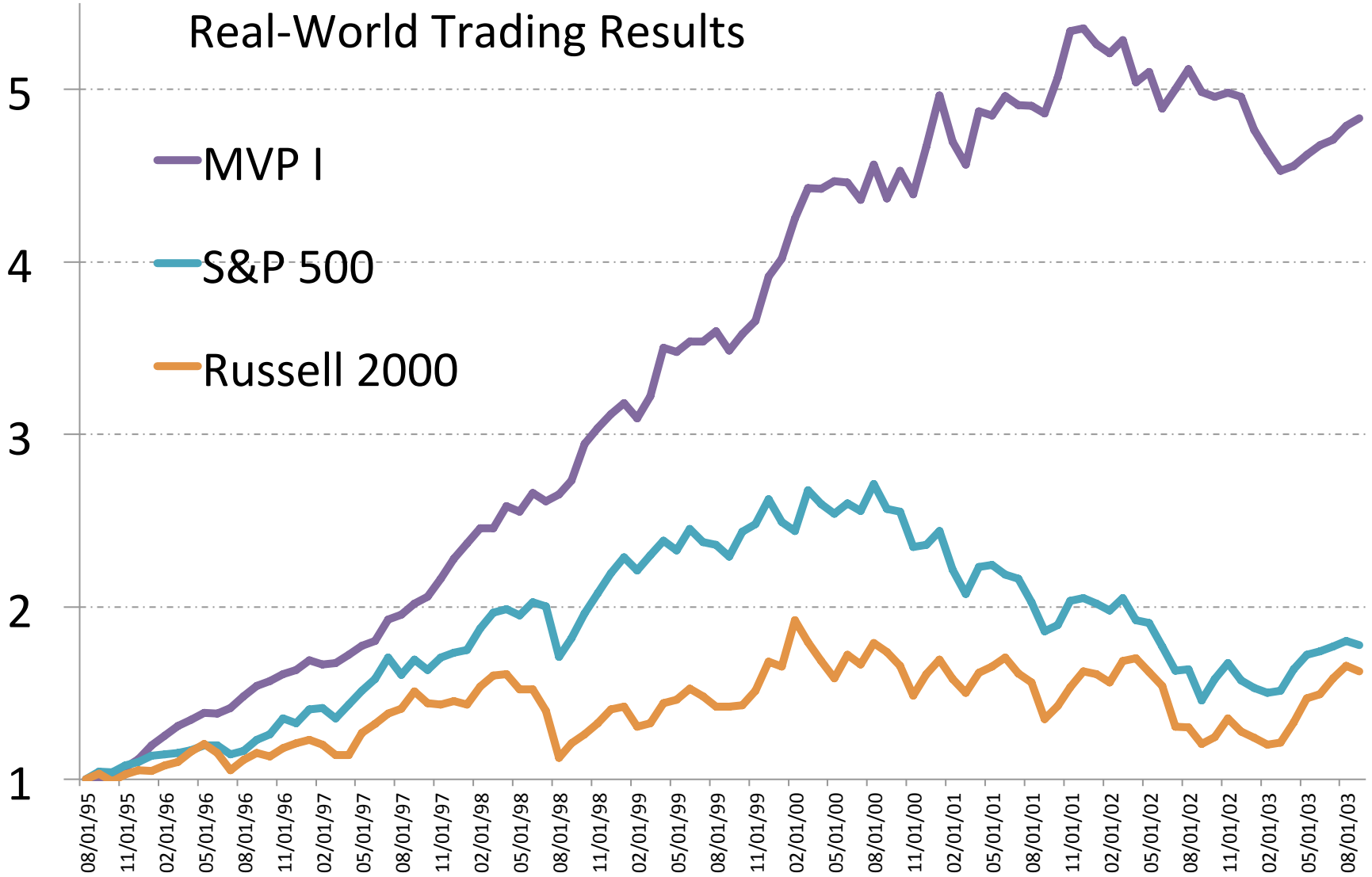
DATA MINING & PREDICTIVE ANALYTICS

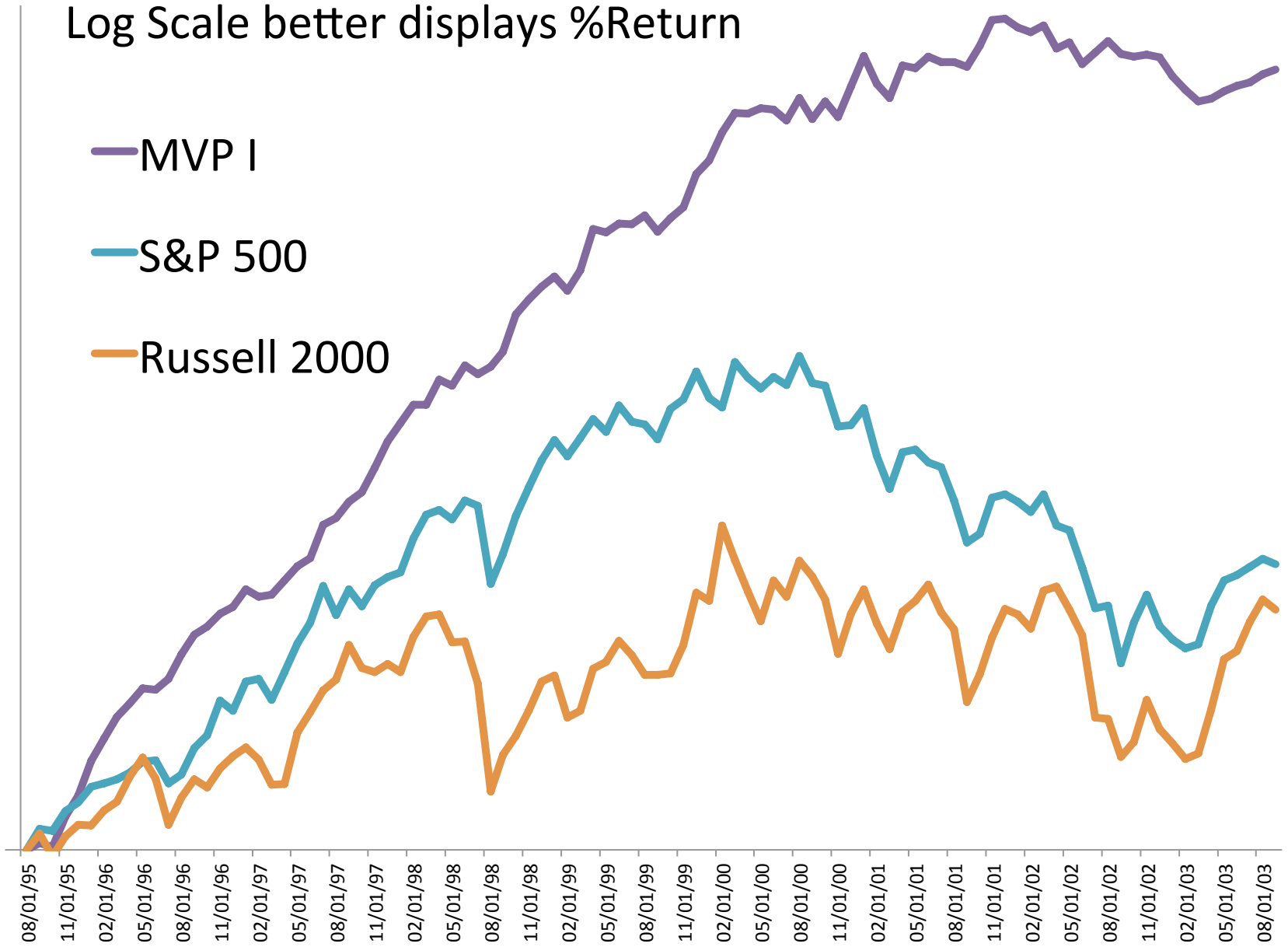
300 West Main St., 3rd floor, Charlottesville, Virginia 22901 434-973-7673 www.datamininglab.com



Investment Modeling

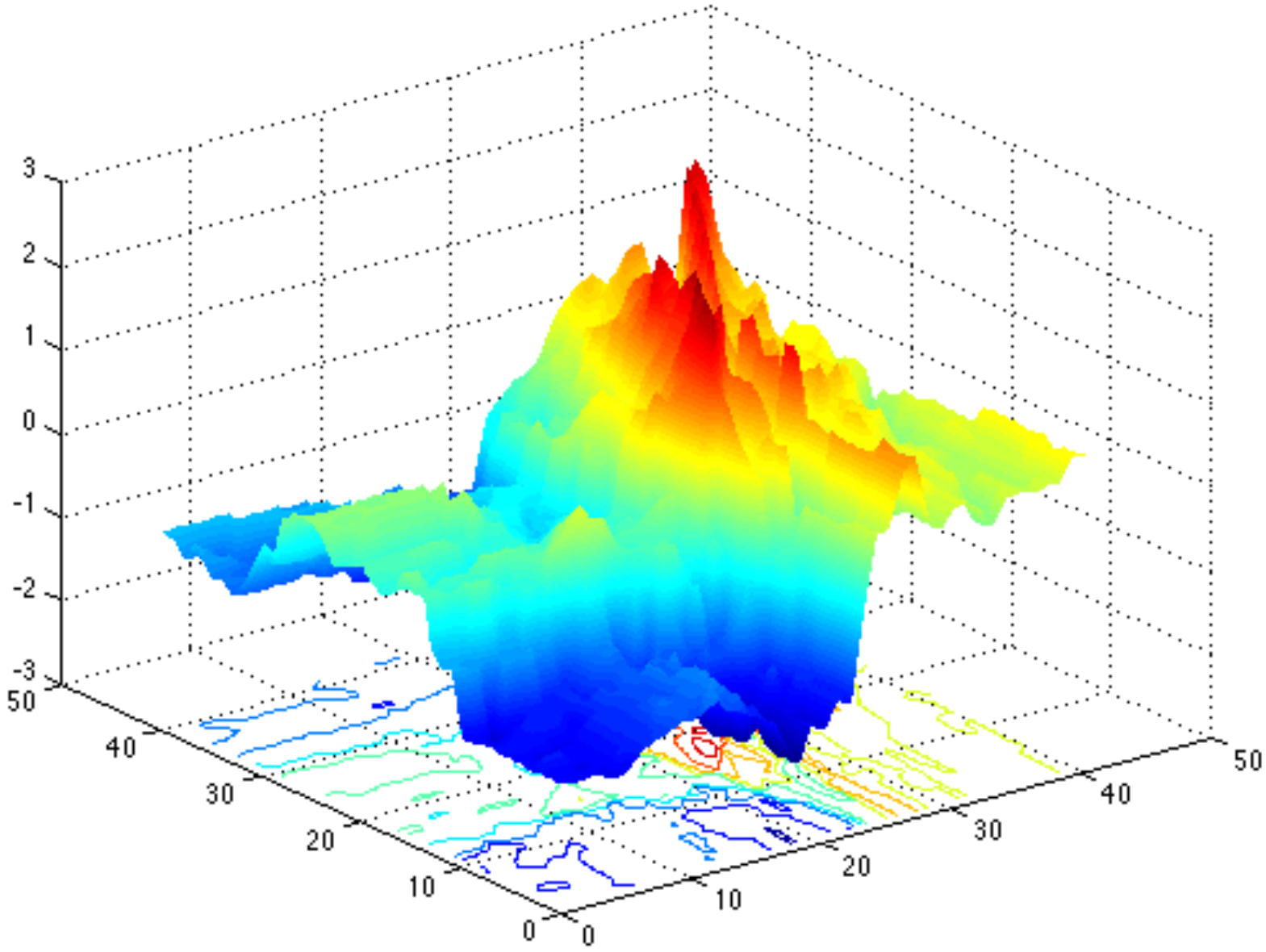
- Success is possible
- Huge reward but even bigger challenges
  - Data is plentiful, but noisy [Bloomburg earnings]
  - Market is almost efficient
  - "Pockets of inefficiency" are trampled if found
  - Skill is almost indistinguishable from luck [coin]
  - The system can change overnight [LTCM]
- Still, the discipline of partially solving these issues has improved much of our other work


Real-World Trading Results
MVP I
S&P 500
Russell 2000
5
4
3
2
1
08/01/95
11/01/95
02/01/96
05/01/96
08/01/96
11/01/96
02/01/97
05/01/97
08/01/97
11/01/97
02/01/98
05/01/98
08/01/98
11/01/98
02/01/99
05/01/99
08/01/99
11/01/99
02/01/00
05/01/00
08/01/00
11/01/00
02/01/01
05/01/01
08/01/01
11/01/01
02/01/02
05/01/02
08/01/02
11/01/02
02/01/03
05/01/03
08/01/03


Log Scale better displays %Return
MVP I
S&P 500
Russell 2000
1
08/01/95
11/01/95
02/01/96
05/01/96
08/01/96
11/01/96
02/01/97
05/01/97
08/01/97
11/01/97
02/01/98
05/01/98
08/01/98
11/01/98
02/01/99
05/01/99
08/01/99
11/01/99
02/01/00
05/01/00
08/01/00
11/01/00
02/01/01
05/01/01
08/01/01
11/01/01
02/01/02
05/01/02
08/01/02
11/01/02
02/01/03
05/01/03
08/01/03

“We found something!”

- A new hedge fund investment system
  (with many months of effort behind it)
  had been reduced to two knobs (parameters)
  which needed setting
- Using a cutting-edge global optimization algorithm
  (not really necessary now that we’re down to 2dimensions)
  we found the best settings resulted in 3% excess return *per month* over a multi-year backtest period
- Could it be real?
  (i.e., Work anything like that going forward?)


3
2
1
0
-1
-2
-3
50
40
30
20
10
0
0
10
20
30
40
50

Data Challenge: Leaks from the Future

- Forecasting example: Interest rate at Chicago Bank.
  Neural net 95% accurate, but ___*output was a candidate input*___.
- Hedge Fund example: Strategy 70% accurate on backtests.
  But was moving average of 3 days, centered on ___*today*___.
- Example: One of our candidate models used *book:price ratio*
  (but historical price was adjusted for splits and dividends)
- Survivor Bias [Dot-Com example]

- Look for (and remove) variables which work too well.
- Date-stamp records when storing in Data Warehouse,
  or don't overwrite old value unless archived.

Custom Score Function

Model Goal: Get the computer to "feel" like you do
[e.g., employee stock grants instead of options]

Most researchers are lulled into the realm of squared error by its convenience (mathematical beauty). But ask the computer to do what's most helpful for the system, not what's easiest for it. [ex: Stock price prediction]

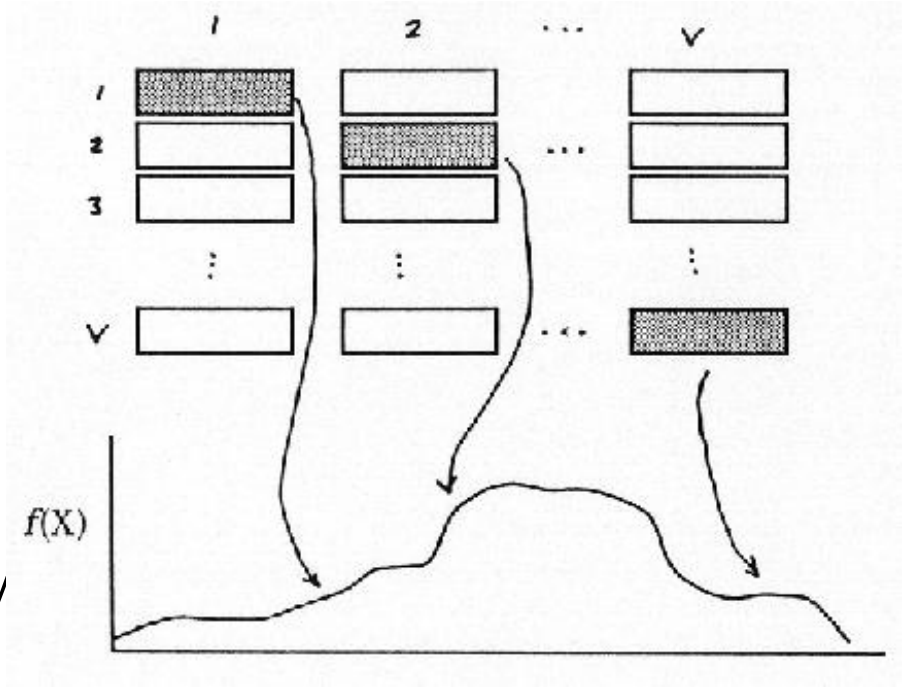
Resampling to Evaluate Accuracy

V-fold Cross-Validation

a) Train V models on different (overlapping) data subsets

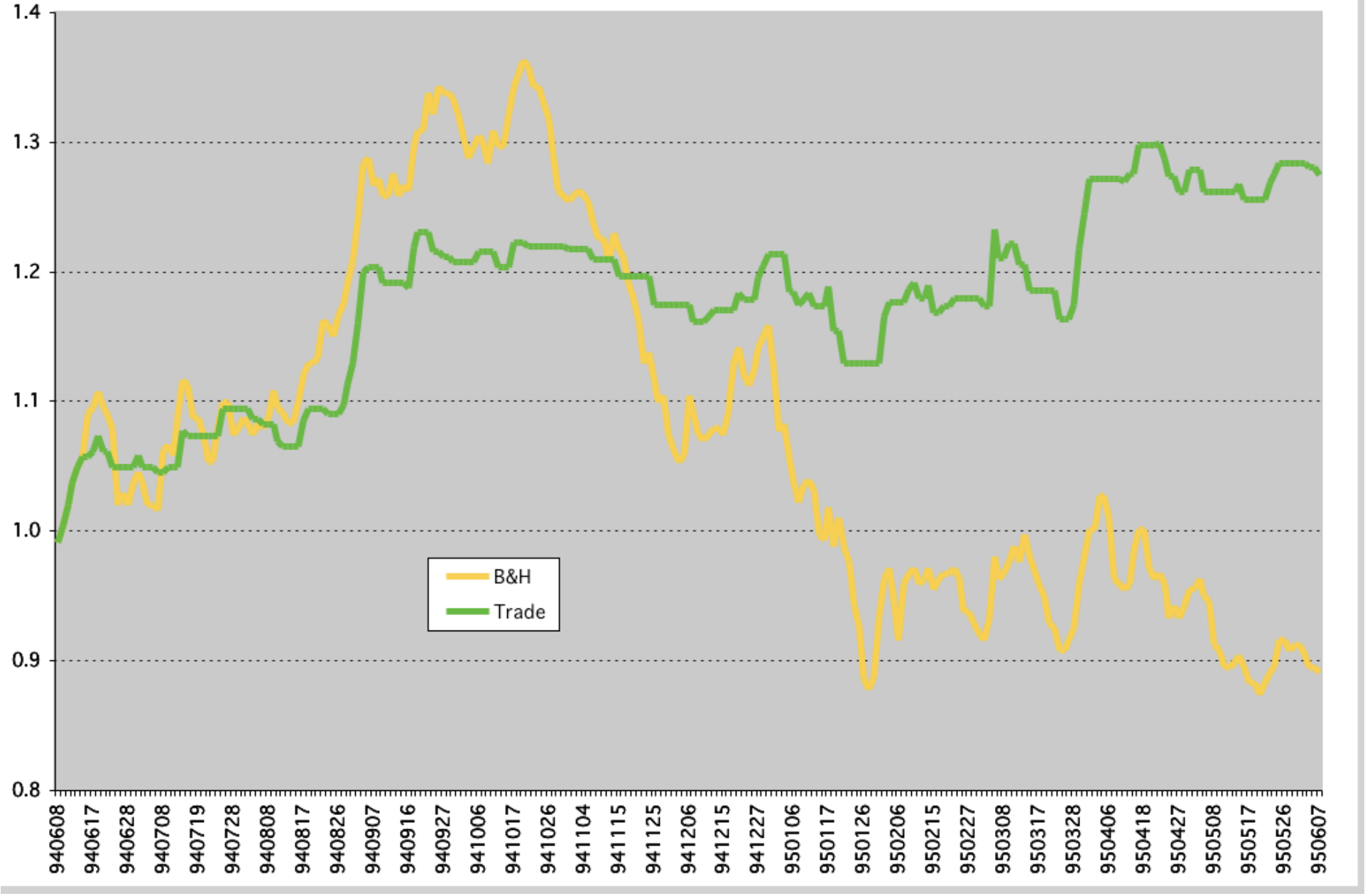
b) Test each on unseen data

c) Use distribution of results to score model realistically



- Vary only the key aspect you want to test
- What you hold constant is what is scored

Trading System Example



Resampling Code Example:

Evaluate the quality of an investment timing strategy

```
READ file "fund_1yr" date position return
MULTIPLY position return trade
SUM trade original
PRINT original

REPEAT 1000
   SHUFFLE position pos
   MULTIPLY pos return trade
   SUM trade total
   SCORE total Z
END
HISTOGRAM Z

COUNT Z > original better
DIVIDE better 1000 prop_bet
PRINT prop_bet
```

5 Lessons Learned

1. Assess the cost and potential rewards
   a. With financial applications, small improvements may lead to large rewards
   b. Latest technology may matter (e.g., Ensembles)
   c. Custom error metrics may be worth the trouble
2. Must have (access to) domain knowledge
   a. Are Kaggle contest results a counter-example to this?
   b. “Domain knowledge is essential to *setting up* a good contest.” - Dean Abbott
   c. Telecommunications example
3. Data is going to be flawed
   a. But don’t let it stop you!
   b. Don’t wait for a data warehouse

5 Lessons Learned (cont…)

4. Work extremely hard to *break* your model
   a. Need outside help
   b. Resampling is essential
   c. Visualize failure
5. Share the work & share the reward

   -> Sharing the pie will usually grow the pie!

John F. Elder IV
Founder, Elder Research, Inc.

Dr. John Elder heads a data mining consulting team with offices in Charlottesville VA ,Washington DC, Baltimore Maryland, and Manhasset New York (www.datamininglab.com). Founded in 1995, Elder Research, Inc. focuses on Federal, commercial, investment, and security applications of advanced analytics, including text mining, stock selection, image recognition, process optimization, cross-selling, drug efficacy, credit scoring, risk management, and fraud detection.

John earned a BS and MEE in Electrical Engineering from Rice University, and a PhD in Systems Engineering from the University of Virginia, where he' s an adjunct professor teaching Optimization or Data Mining. Prior to 17 years at ERI, he spent 5 years in aerospace defense consulting, 4 heading research at an investment management firm, and 2 in Rice's *Computational & Applied Mathematics* department.

Dr. Elder has authored innovative data mining tools, is a frequent keynote speaker, and has chaired international Analytics conferences. Dr. Elder was honored to serve for 5 years on a panel appointed by President Bush to guide technology for National Security. His Handbook on *Practical Data Mining*, with Bob Nisbet and Gary Miner, won the 2009 PROSE Award for Mathematics. His book on *Ensembles* with Giovanni Seni was published in 2010, and a book on *practical text mining* – with Fast, Delen, Miner, Nisbet, and Hill – won the 2012 PROSE Award for Computer and Information Science.

John' s grateful to be a follower of Christ and the father of 5.