

Development of Dynamic ATR

Dr. Matthew Merzbacher

Manager, Machine Vision & Innovation
Morpho Detection, Inc.

October 24, 2012

CONCLUSION

→ **We don't know what we don't know**

- But surely we can expect to know more tomorrow than we do today

DYNAMIC ATR

→ Why should ATRs be dynamic instead of static?

- Changes in environment
 - Threats
 - Intelligence
 - Policy
 - Protocol
 - False Alarms
- Changes in technology
 - New solutions
 - Improvements to existing solutions
- Changes in knowledge
 - New things are learned
 - Mistaken notions are unlearned



SCIENCEPHOTOLIBRARY

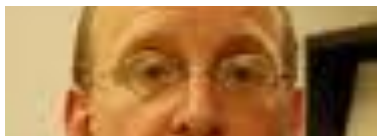
Must adapt quickly, safely, and in a well-understood fashion

LEARNING TO CRAWL



North Carolina physics professor in Argentine jail on drug charges

By Joshua Rhett Miller / Published March 20, 2012 / FoxNews.com



Paul Frampton, UNC Physics Professor, Asks For Double His Salary From Argentine Prison

Posted: 10/24/2012 1:14 pm EDT Updated: 10/24/2012 1:15 pm EDT

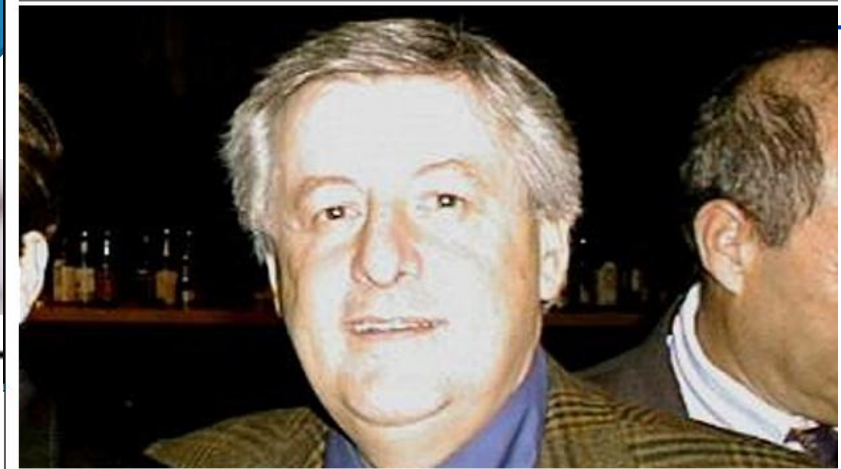
The Telegraph

HOME NEWS WORLD SPORT FINANCE COMMENT BLOGS CULTURE TRAVEL LIFE
Politics Obits Education Earth Science Defence Health Scotland Royal Celebrities

HOME » NEWS » UK NEWS » LAW AND ORDER

Distinguished British scientist faces 16 years in Argentine jail after being caught with suitcase of cocaine

A distinguished British scientist is languishing in an Argentine jail on suspicion of drugs smuggling.



ONS | SPORT | LIFE | PROPERTY | ARTS & ENTS | TRAVEL | MONI
| Science | Environment | Media | Technology | Education | Olympics | Obitu

'caught with 2kg of cocaine' held

WHAT MIGHT THE “SOMETHING” BE?

→ Intelligence information

- National
- Local

→ Passenger (lack of) risk

- Registered Travelers
- Behavioral Markers

→ Specific threat catalogue

- Explosives, Weapons, Contraband, etc.

→ Prior data & scans of item

→ Recent similar results

- Fooling inductive systems

→ Practical considerations

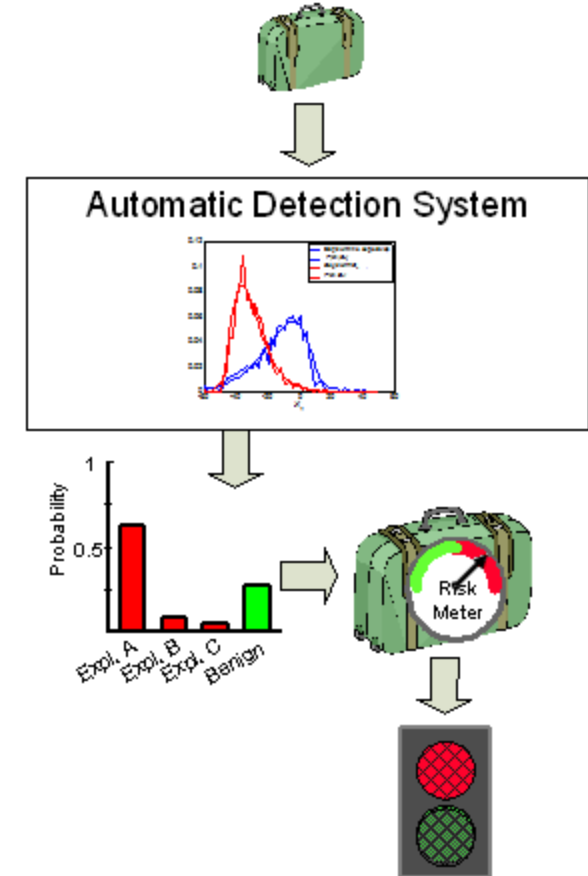
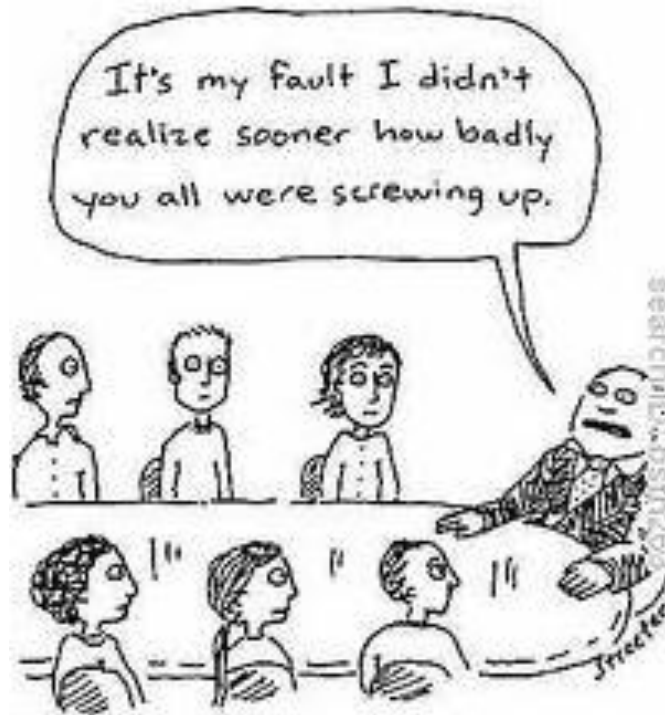
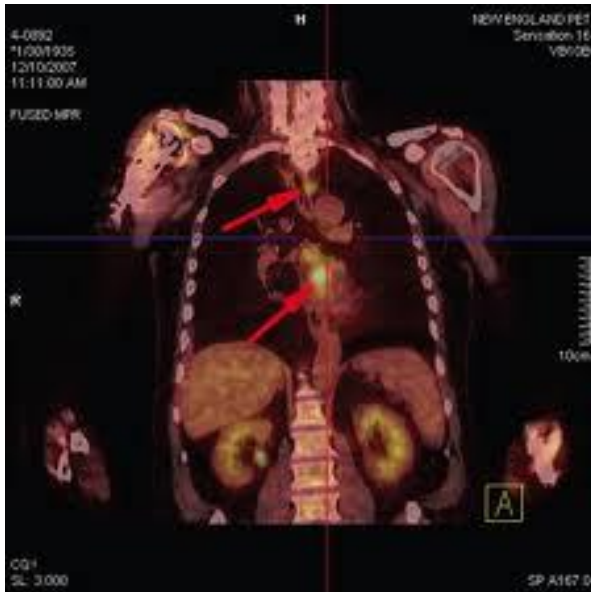
→ Randomized element

→ Other

Need comprehensive framework for combining knowledge / control / info

IMPLEMENTATION AND DEPLOYMENT CONSIDERATIONS

- How do we combine the results of two ATRs for presentation?
- How do we control dynamic behavior?
- How do we understand dynamic choices?



A WAR STORY

→ Re-classification of alarms

- Based on inductive knowledge

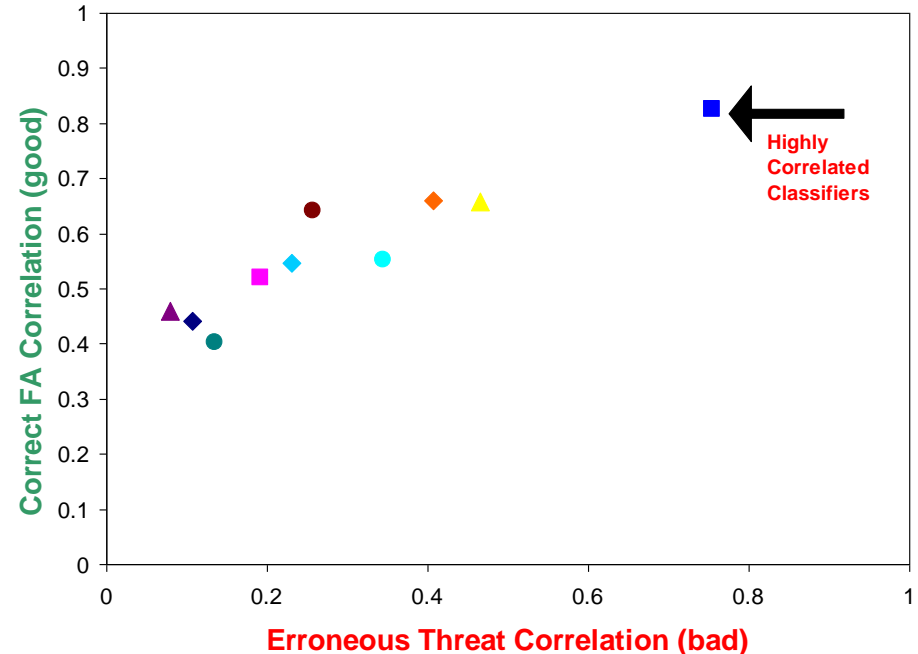
→ Voting re-classifiers

- Used prior information
- Combination of techniques
- Voting: Best 3-of-5 (or 6-of-7, or...)
- Simple report on why a choice was made

→ Two problems

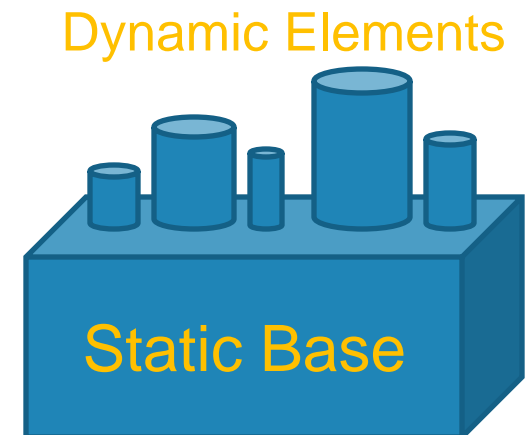
- Misclassification (used wrong voters)
 - Bad in some cases, Worse in others
- Correlation of voting behavior
 - Good and Bad

Limiting control improves reporting and robustness at the expense of optimization



MORE SOPHISTICATED DYNAMIC BEHAVIOR

- **What should change in an ATR over time? What should not change over time?**
 - Can we create an ATR with a static portion and a dynamic portion?
- **How should we specify behavior of a dynamic ATR?**
- **Is there a useful general framework for combining components dynamically?**
- **What about reporting?**
- **How do we avoid overtraining?**
- **And what about testing/evaluation (with limited resources)?**
 - Appropriate testing at both component and system level
 - Simulation
 - Monte Carlo
 - Live testing
 - Black Box and White Box testing
 - Ongoing/Evolutionary



CRAWBACHER LIST

- **Why should ATRs be dynamic instead of static?**
- **What should change with ATRs over time?**
- **How is the ATR function of:**
 - Threat level?
 - Intelligence information?
 - Passenger risk?
 - Deterrence?
 - Randomization?
 - Other?
- **How do we prevent overtraining?**
- **How should requirement specs be set?**
- **Should a vendor or a third party develop the dynamic ATR?**
- **How should the following tests be conducted for a dynamic ATR?**
 - CRT
 - Certification/qualification
 - FAT/SAT
 - Red team
- **How should the various flavors of an ATR be implemented, deployed and activated in the field?**
- **Should TSA procure scanners w/o ATRs?**

CONCLUSION

→ **We don't know what we don't know**

- But surely we can expect to know more tomorrow than we do today
- Therefore, we should prepare a framework to take advantage of tomorrow's advances, whatever they may be
 - Technology, Knowledge, Policy: Fusion
 - Understandable, Controllable, Tunable, Testable