ATR and Homeland Security

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SIAC2003 – Homeland Security Computing

Wright State University

Information Technology Research Institute

Ohio Supercomputer Center

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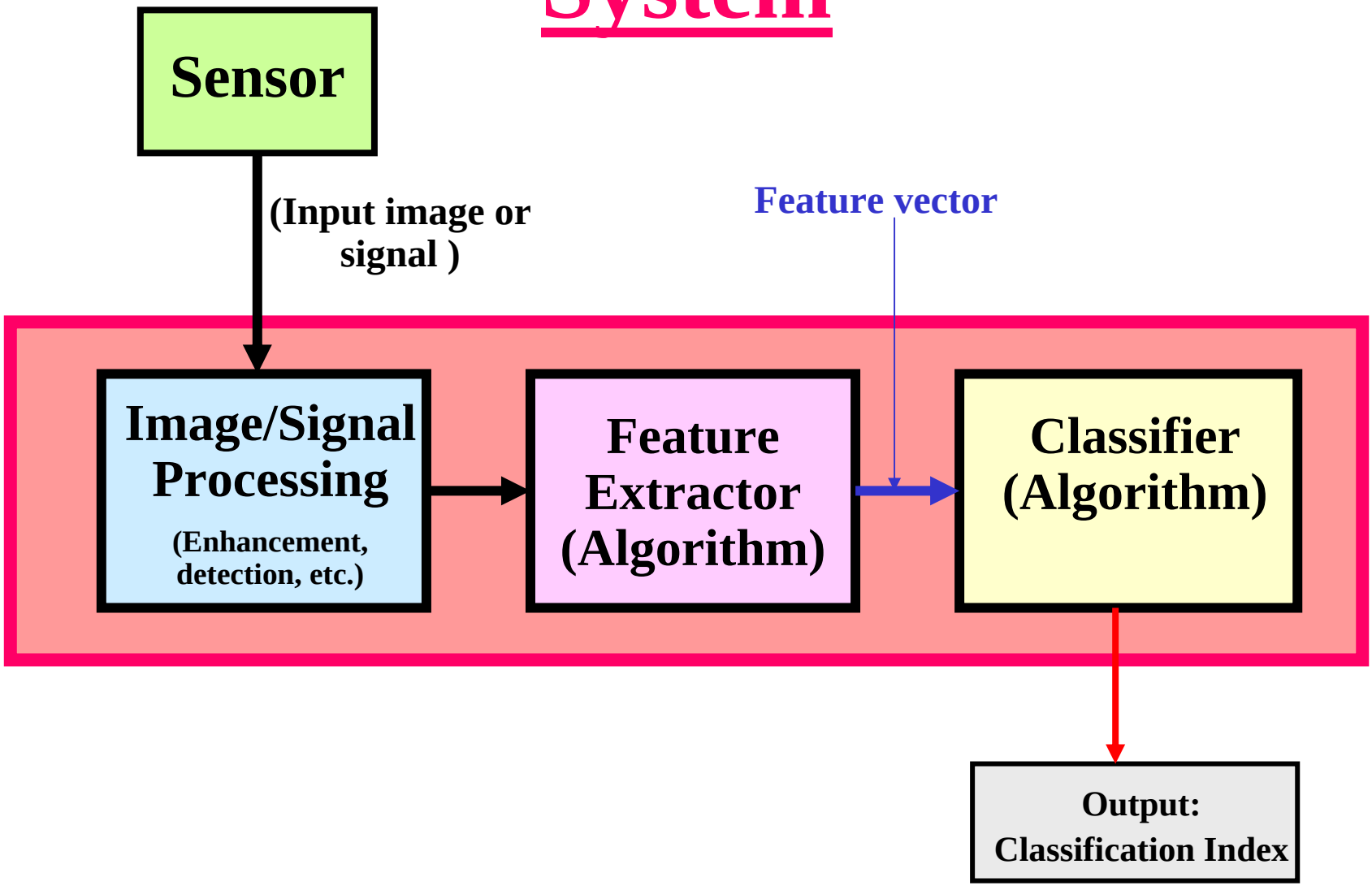
Things are now different

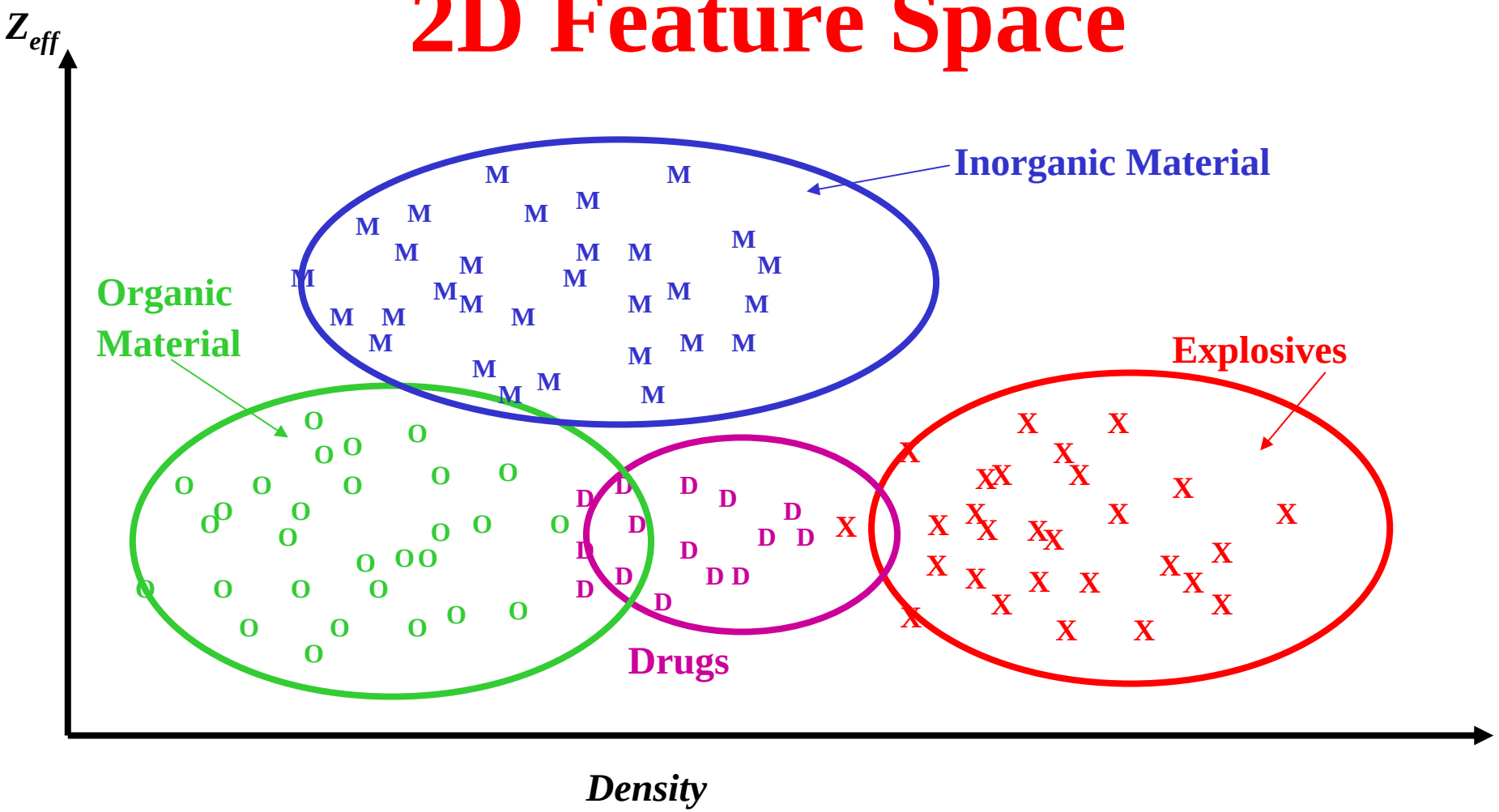
Outline

- What is Automatic Target Recognition (ATR)
- Terrorist threats
- Examples of HS applications
  - Biometrics
  - Airport security
  - Border and transportation
  - Activity Monitoring
- ATR research examples
- Conclusions

Pattern Recognition (PR) System



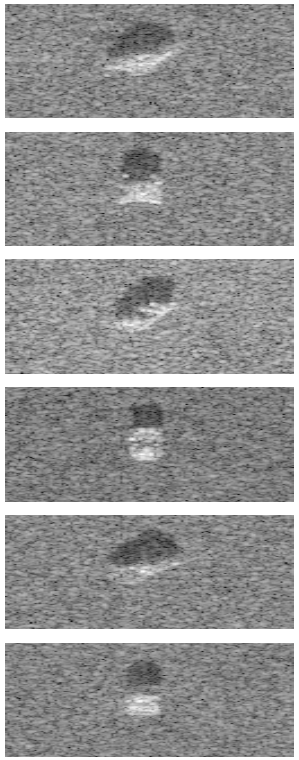
2D Feature Space



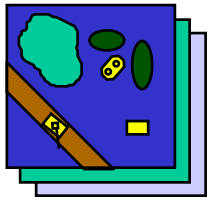
The role of effective atomic number and density in separating explosives from other material. Used in dual energy X-ray systems.

Automatic Target Recognition

- Automatic Target Recognition (ATR) receives sensor data as input and provides target classes, probabilities, locations and orientations as output.
- ATR involves the use of training and test sets, features, classifiers and discriminators for design and development of algorithms.



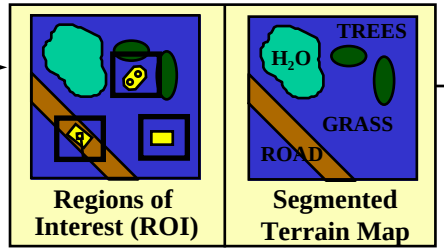
Moving and Stationary Target Acquisition and Recognition (MSTAR)



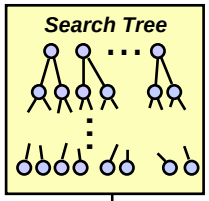
SAR Image & Collateral Data
- DTED, DFAD
- Site Models
- EOSAT imagery

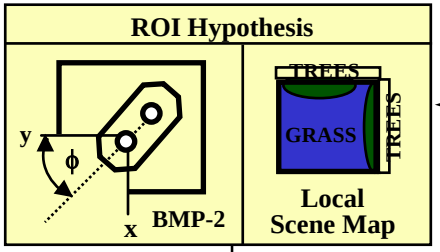
Focus of Attention

Target & Clutter Database



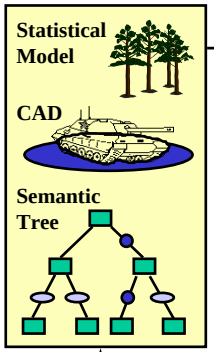
Index Database (created off-line)





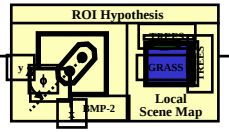
Indexing

Target & Scene Model Database (created off line)



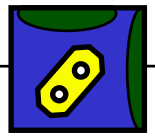
Predict

Task Predict



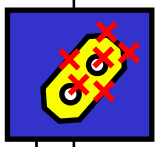
Search

Task Extract

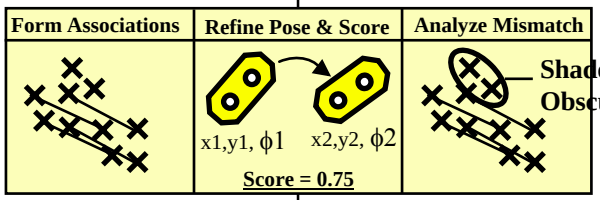


Extract

Clutter Database



Match Results



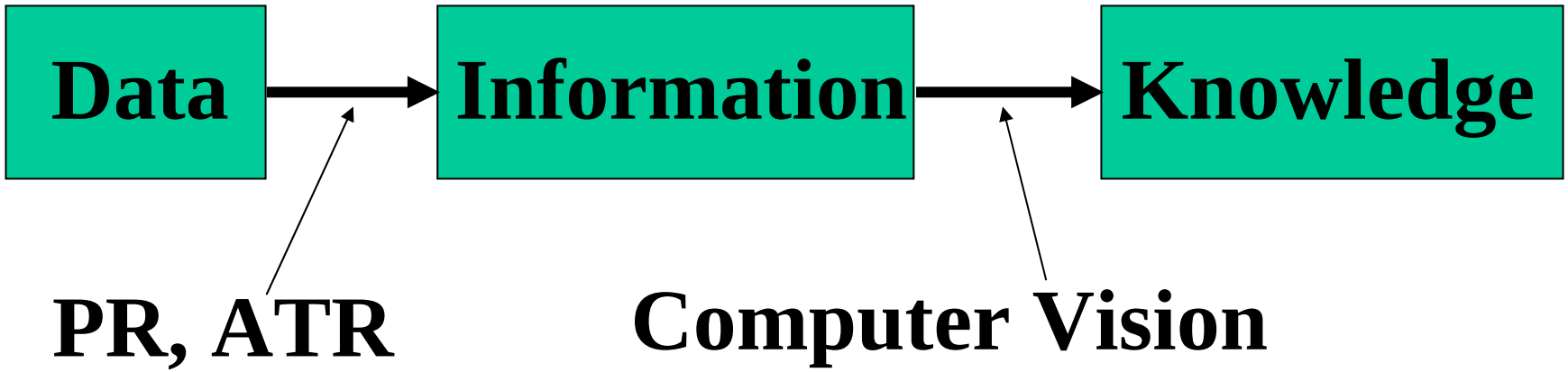
Tree Clutter

Ground Clutter

Feature-to-Model Traceback

Match

Higher-Level Image Processing



- ***Computer vision***, ***image understanding***, ***machine vision***, or ***image analysis*** are terms that refer to systems for transforming images into descriptions related to scenes.

Some Current ATR Challenges

- Combinatorial explosion of target signature variations
- Complex backgrounds (false alarm rates)
- Prediction of field performance
- Real time operations (new target insertion)
- Expensive data bases and software development effort

Closely Related Areas and Tools

- **Artificial Intelligence:** expert systems and machine learning
- **Cognitive Sciences** and **Biological Perception**
- **Soft Computing:** evolutionary computing, neural networks, fuzzy sets
- **Mathematics:** geometry, topology, harmonic analysis, algebra, probability/statistics ,graph theory, nonlinear optimization, approximation theory, numerical analysis, parameter estimation
- **Sensors:** design and modeling

Lockerbie Scotland, 1988

Photo credit: Federal Aviation Administration

Flight deck of commercial aircraft destroyed by terrorist bomb; Lockerbie, Scotland, 1988.

From 1985-97, eight aircraft and 1100 people died in suspected terrorist bombings

Terrorist Technology

- Explosives run the gamut from nuclear fission, fusion, or dirty nuclear bombs through plastic explosives, to pipe bombs, or simple hand grenades.
- There are biological agents including viruses, bacteria, micro-organisms.
- Chemical agents encompass nerve gases, cyanides, phosgene, and vesicants.

Intended Targets Include

- Transportation and telecommunications
- Air, water and food supplies
- Energy sources and distribution channels
- Financial and computer networks
- Factories; key buildings
- Population groups
- Prominent individuals.

Means of Delivery

- Mail (anthrax letters)
- Internet
- Missiles and aircraft (9/11)
- Ships and submarines
- Trains, trucks, auto
- On foot
- By remote detonation

DARPA's Top Technology Needs

Gathering Information

- Biometrics
- Border&Transportation Security
- Image understanding
- Bio-chem sensors
- Data mining

Gathering Knowledge/Intelligence

- Early warning & profiling tools
- Fusion of information and data
- Decision support systems
- Language understanding

Conference Topics/Speakers

ATR & Examples: biometrics, scanning systems, traffic monitoring (Tamburino)

Biometrics (Guiterrez)
Surveillance sys. (Parent)
Data mining (Dong)
Biocomputing (Ewing)
Visualization Tools (Lajerskar)

Security Offender (Krane)
Supercomputing (Stutz)
Electric Grids(Tsoukaias)
Security vs. privacy (Bowyer)
Information Security (Bourbakis)
Mobile Computing (Agrawal)
Security systems (Mateti)
Mobile computing (Agrawal)
Secure knowledge (McQuay)
Database security (Chung)
HS Computing (Narayanan)

***Biometrics** refers to a set of technologies that utilize human characteristics or behavioral traits to identify particular individuals.*

- Example of fingerprint analysis systems, which can recognizes a print in < 0.5 sec. (*photo from NTT in Japan*)

Mainstream Biometrics*

Biometric	Identify vs. Verify	How Robust	How Distinctive	How Intrusive
Fingerprint	Either	Moderate	High	Touching
Hand/Finger Geometry	Verify	Moderate	Low	Touching
Retinal Scan	Either	High	High	1-2 in.
Iris Scan	Either	High	High	12+ in.
Facial Recognition	Either	Moderate	Moderate	12+ in.
Speaker Recognition	Verify	Moderate	Low	Remote
Dynamic Signature Verification	Verify	Low	Moderate	Touching
Keystroke Dynamics	Verify	Low	Low	Touching

*The RAND Biometric Team, ARROYO CENTER (Based on work done for the U.S. Army June 2000)

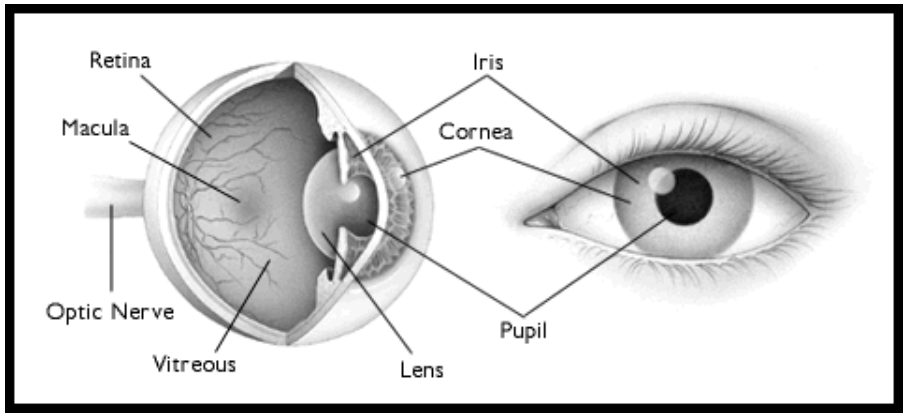
Voice Biometrics

- Non-intrusive and natural to use
- Callers access the system using a standard telephone, identify themselves with a unique user ID and speak a pass phrase. (verification)
- Voice print cannot be lost or stolen
- Pass phrase compared to voice print template
- Provides verification

Hand Recognition

- Biometric verifications systems use the size and shape of a person's hand to help speed them through border crossings.
- This technology is already at work at Israel's Ben Gurion International Airport with millions of inspections already completed. *(Recognition Systems, Inc.)*

Retina Scan Technology



- Along with iris recognition technology, retina scan is perhaps the most accurate and reliable biometric technology.
- Among the most difficult to use, and is perceived as being somewhat intrusive.
- Enrollment failure is 5-10 % (iris scan biometrics has similar difficulty).

Accuracy and Performance

- Retina scan - one inch from capture device.
- User looks at a rotating green light as the patterns of the retina are measured at over 400 points. (fingerprint provides 30-40 distinctive points)
- False Accept. Rates (FAR) as low as .01%
- False Rejection Rate (FRR) as high as 10%

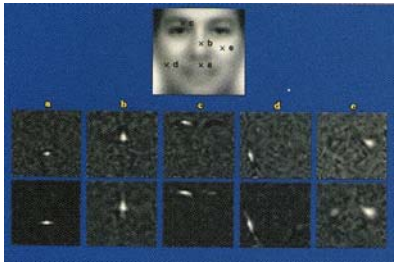
Facial Pattern Recognition

- **Segmentation -** crops faces from background
- **Face Detection -** single or multiple faces in complex scenes
- **Face Recognition -**either of the following:
  - **Authentication (one-to-one matching)**
  - **Identification (one-to-many matching)**
- **Tracking -** known face over multiple video frames
- **Robust -** pose, lighting, etc.
- **Template representation -** minimal number of bits


Faceit DB/Surveillance - [Surveillance - Gallery Database: Polaroid]
File Options Preferences History View Window Help
Grabs
102 103 104
105 106 107
108 109 110
111 112 113
114 115 116
117 118 119
120 121
Face Captured
Start Grab
Grab Frame
Search
Enroll
Close
Surveillance Objective: Express Search
Faces Captured: 122
Faces Recognized: 91
Frame Rate: 4.3
Approx. Grab Delay: 0s
Approx. Search Delay: 0s
Grab Frame Buffer:
Search Queue:
Searches
106 107
108 109
110 111
112 113
114 115
116 117
118 120
121
Faceprint distinguishes one face in a million

Visionics’ FaceIT®

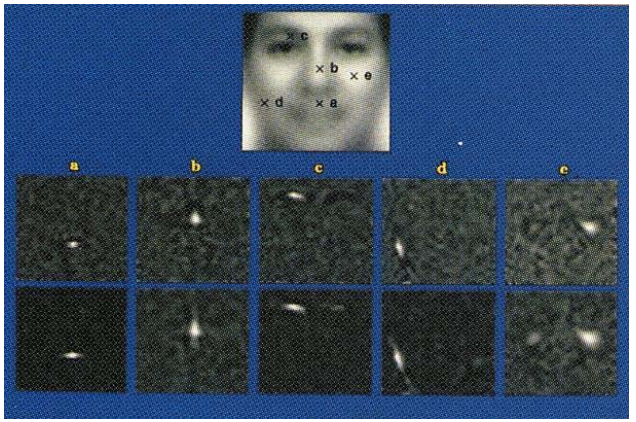
- State-of-the are system
- Generates ID codes "based on 80 unique aspects of facial structures, like the width of the nose and the location of the temples”



How It Works

- FaceIt® Uses Local Feature Analysis (LFA) to represent facial images in terms of local statistically derived building blocks
- All facial images can be synthesized from a set of basic building elements.
- LFA uses sophisticated statistical techniques to derive them from a representative ensemble of faces

How It Works



- There are many more facial building elements than there are facial parts.
- However, only a small subset is needed to synthesize a given facial image
- Identity is determined by which elements are characteristic and their relative positions

Visionics' FaceIT®

- **Faceprint -** A digital code or internal
- template, unique for each person
- **Compressions** facial images down to 84 bytes
- **Pose variations** up to 35 degrees in all directions
- **Resistant to changes** in lighting, skin tone, eyeglasses, facial expression and hair
- **Scans millions of records** in the blink of an eye

FaceIT® Performance

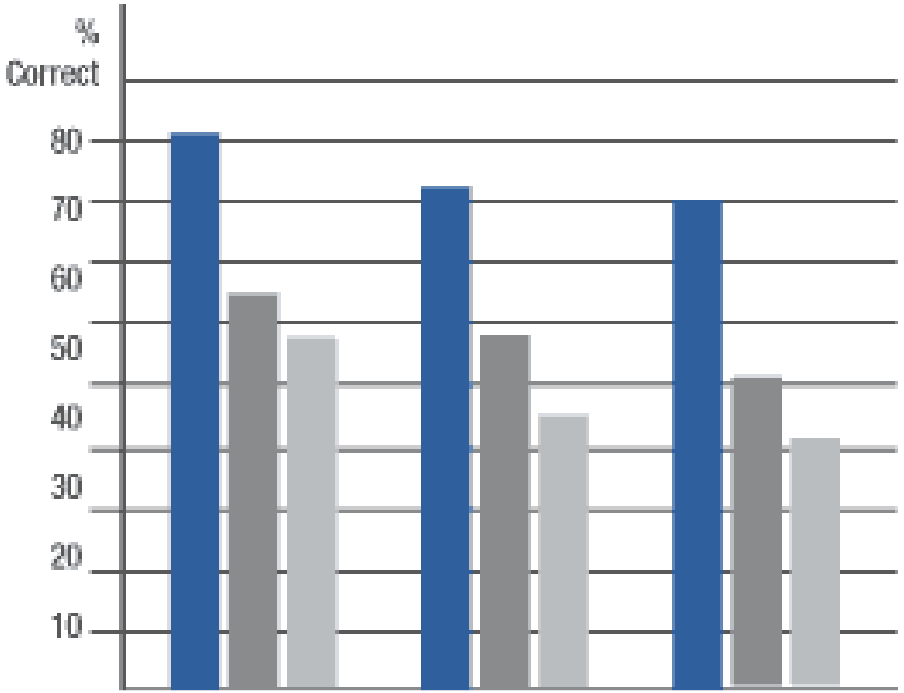


Figure 1 – Identification test performance. Rank 1st identification performance as a function of gallery size

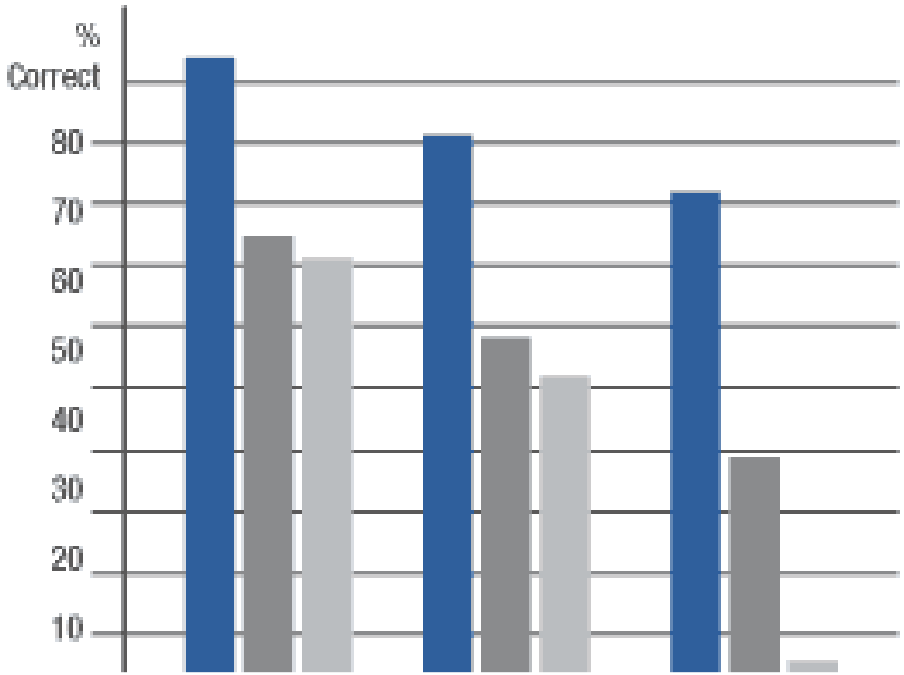
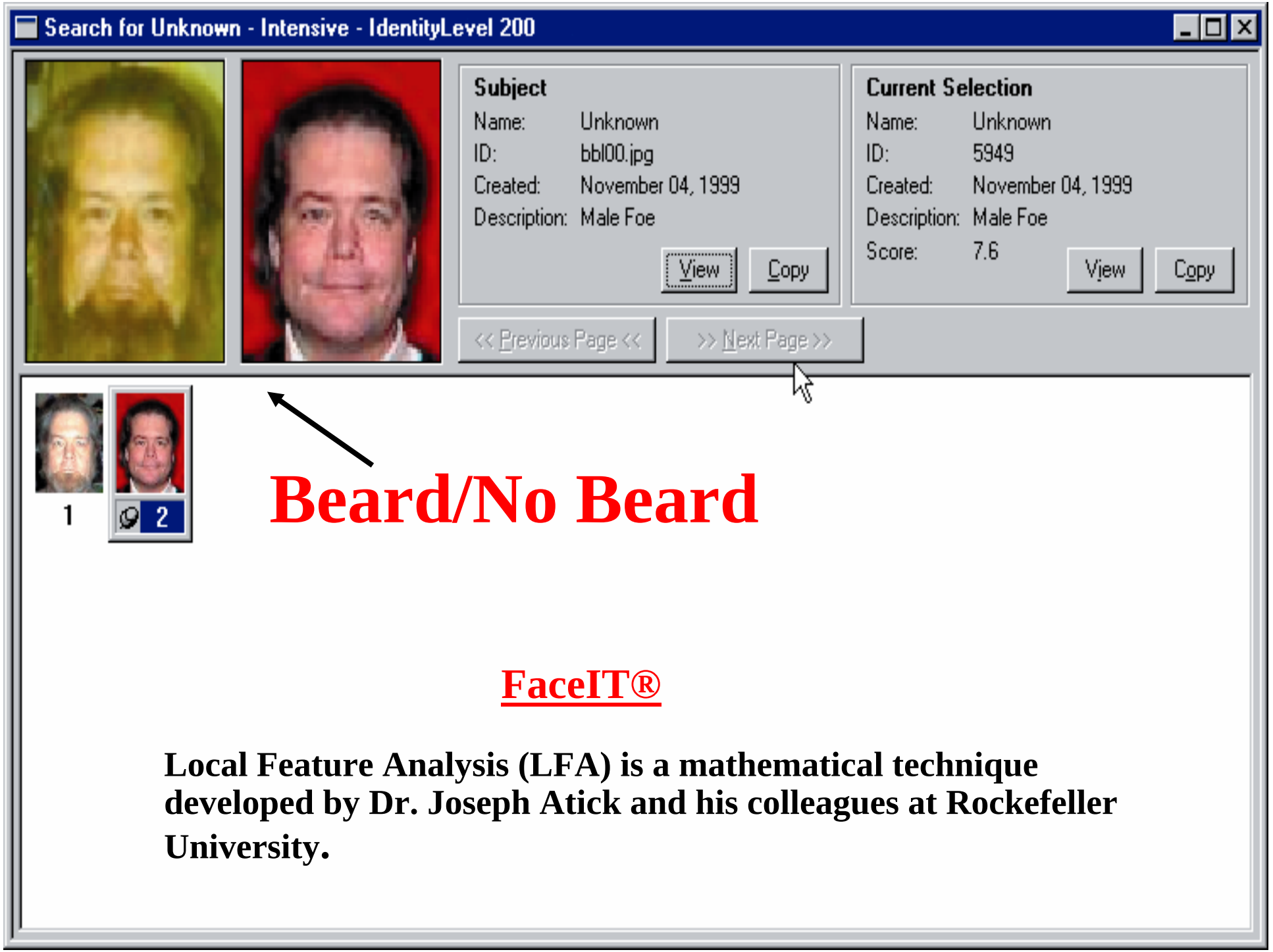


Figure 2 – Verification (authentication) performance at different false acceptance rates.

The Government's Facial Recognition Vendor Test 2002 was independently evaluated by DOD, NIJ, DAPA, and NAVSEA


Search for Unknown - Intensive - IdentityLevel 200
Subject
Name: Unknown
ID: bbl00.jpg
Created: November 04, 1999
Description: Male Foe
View
Copy
Current Selection
Name: Unknown
ID: 5949
Created: November 04, 1999
Description: Male Foe
Score: 7.6
View
Copy
<< Previous Page <<
>> Next Page >>
1
2
Beard/No Beard
FaceIT®
Local Feature Analysis (LFA) is a mathematical technique developed by Dr. Joseph Atick and his colleagues at Rockefeller University.

Seat-Based Body Sensors

- "The thin-film sensors could aid cabin crew in monitoring passengers for things like anxiety or high stress or someone who has been motionless for some time," said Mel Foster of QinetiQ Plc, the British government-owned company behind the sensors.
- $10 sensor is essentially a polygraph built into each seat.

July 25, 2002 DOJgov.net newswire
FARNBOROUGH, England

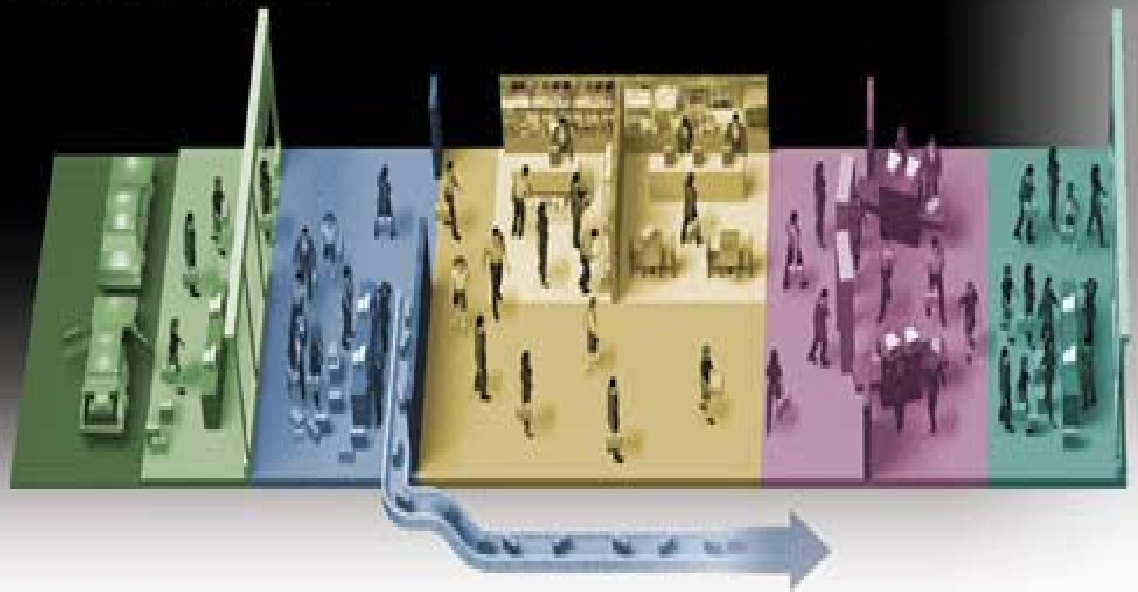
Border and Transportation
(Air, Rail, Sea, Surface)

- Security screening of:
  - People
  - Baggage and package search
  - Entry Point (Cargo) Screening
- Searching for terrorist threats:
  - Explosives and weapons
  - Chemical and biological substances

Commercial Airport Security

HOLES IN THE SECURITY NET

A major airport employs thousands of people working for dozens of companies. Although only "badged" workers should have access to a plane, and passengers and bags are screened, there are myriad opportunities for workers and passengers to bypass security points



CURBSIDE CURBSIDE CHECK-IN RESTAURANTS SECURITY BOARDING ON THE TARMAC

Vehicles Baggae People Cargo, Vehicles

TIME graphic by Joe Lertola; Source: Dr. Todd Curtis, AirSafe.com

Security Screening Technology

- **Emerging technologies** are based on either imaging or trace detection.
- **Trace detection** samples very small quantities of air or material from the clothing or bodies of people to perform a chemical analysis.
- **Imaging techniques** include x-rays, gamma rays, millimeter and microwave systems.

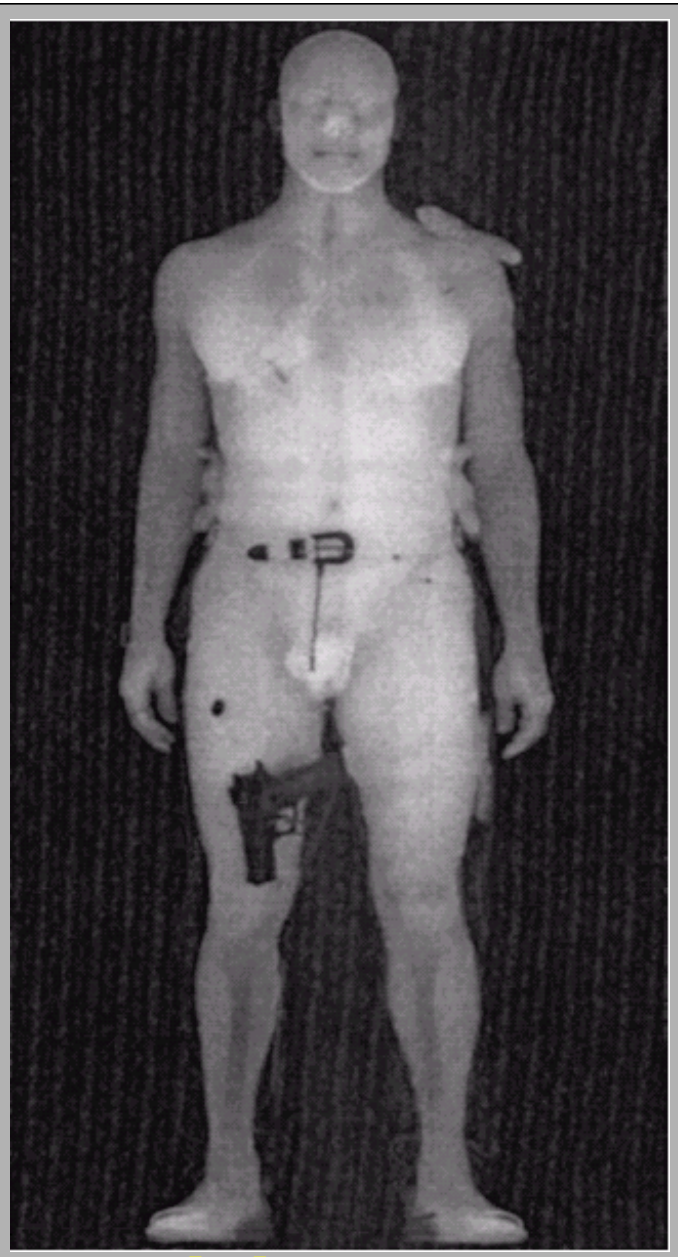
Human Element

- Airport screener's training in US is 12 hr
- Starting salaries $6.00 or less and turnover rates approx. 200% (one airport with 416%)
- Large airport checks millions of pieces of luggage per year (requires 6 sec. per item).
- In 1987 screeners missed 20% potentially dangerous objects (rate is still typical)
- **Hence demand for ATR**

Backscatter X-ray System

AS&E BodySearch™

- Scanning requires subject stand front of scanner for several second and the same for rear scan.
- Radiation is safe (2 0,000 x smaller than a medical X-ray)
- BodySearch is available commercially
- However research is still being conducted to explore automated image analysis.



Concealed weapons are readily seen.

AS&E BodySearch

- High Z materials
  - appear dark
  - good absorbers
  - -metals
- Low Z materials
  - appear bright
  - good scatters
  - drugs, explosives
  - body itself

Millimeter-wave Portal

Developed by Battelle's Pacific Northwest National Laboratory (PNNL) for FAA to scan airline passengers and licensed to SafeView Inc.

Courtesy: FLC Far West News

Holographic Imaging

- When someone walks through the portal, the person is "illuminated" with high-frequency radio waves that form a detailed picture on the screen
- Very low power is safe for human body. (except for privacy concerns)
- System detects plastic or ceramic weapons, plastic explosives, and other non-metallic contraband
- Holographic images are interpreted by operator, but research is being done to automate threat detection capabilities needed for interpretation.

Holographic image of subject in millimeter-wave portal develop by Battelle Northwest National Laboratory. Array operating in the Ku band (10-20GHz).

How It Works

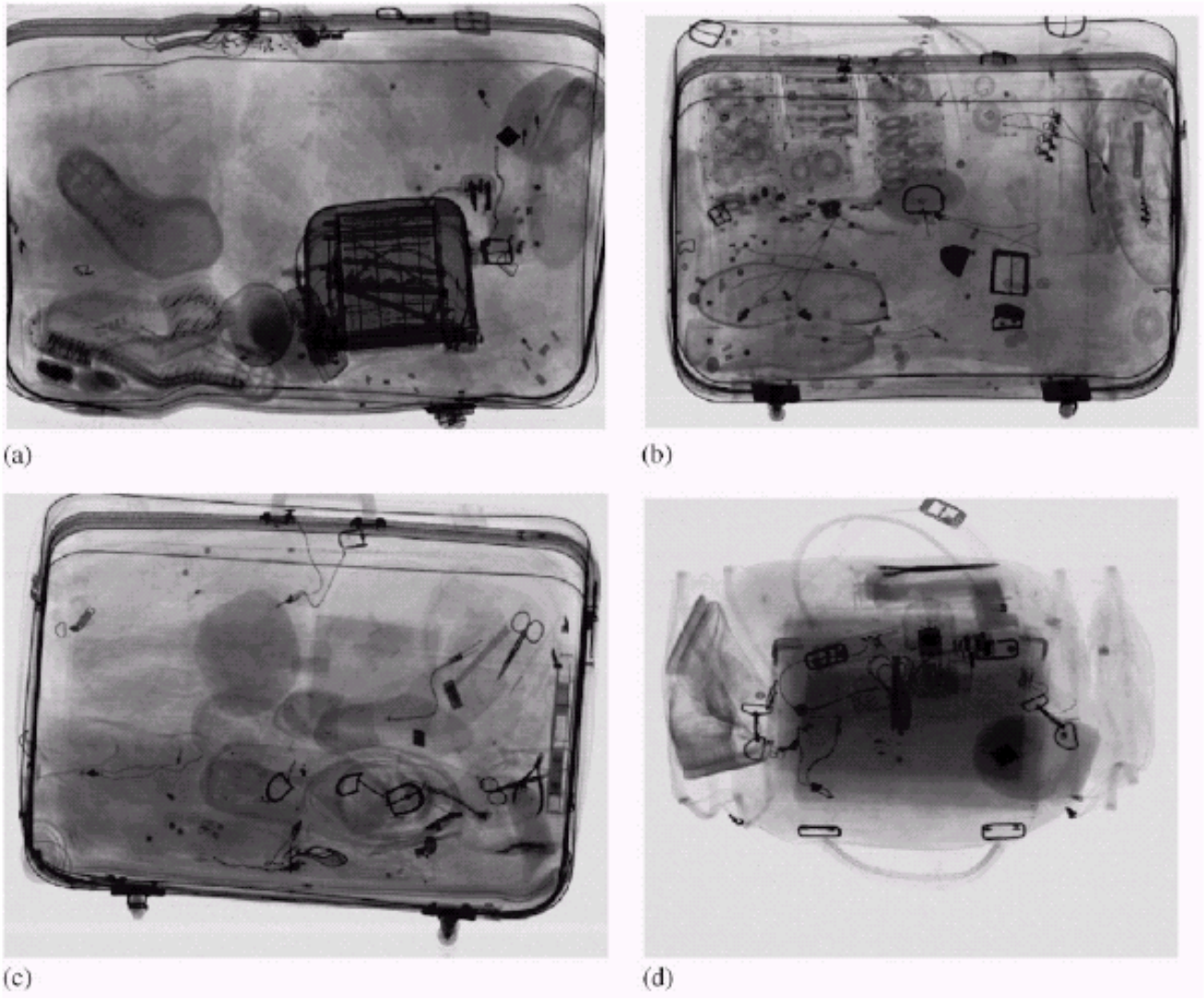
- System projects ultrahigh frequency, low-powered radio waves onto the front and back of the person being screened.
- These waves penetrate clothing and bounce off the person and carried objects.
- A sensor array captures the reflected waves.
- Computer analyzes the information and produces a high-resolution, 3D image.
- Operator screens for suspicious materials.

Explosive Detection System (EDS)

- As a result of losses due to terrorist bombings, research into advanced screening technology has become a priority.
- Most concern is checked and early-on baggage.
- Other concerns relate to monitoring for weapons and detecting illegal objects.
- As detection technology advances so have methods to disguise such materials.

Conventional X-rays

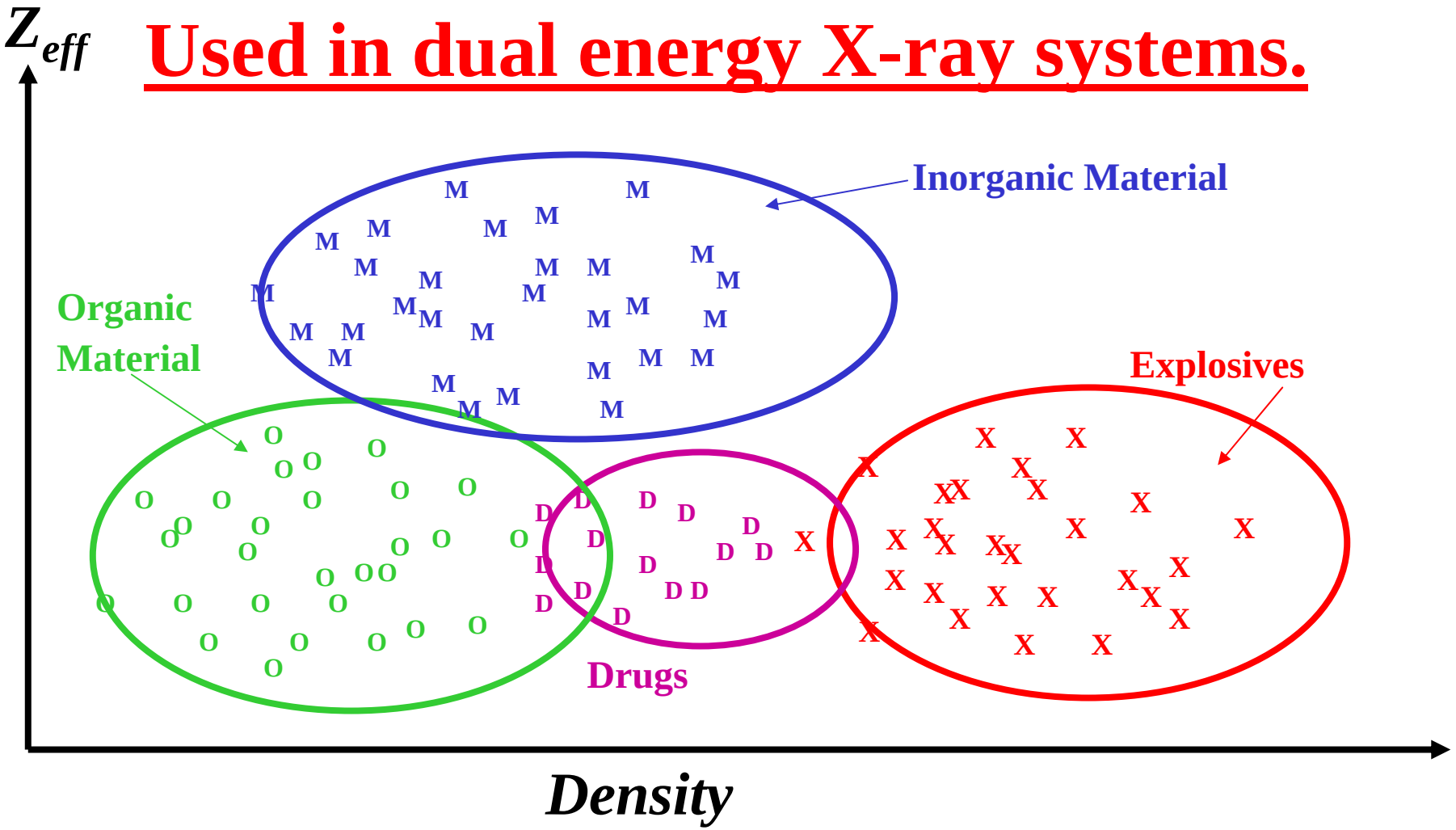
- High quality transmission images are derived from measuring the degree of absorption encountered.
- Devices cannot distinguish between a thin sheet of strong absorber and a thick slab of weak absorber.
- Explosives not obvious to operators.



Some examples of the conventional X-ray of luggage at airports.

Feature Space

Used in dual energy X-ray systems.



The role of effective atomic number and density in separating explosives from other material.

Dual Energy X-ray

- At higher energy levels, above 100 KV, absorbed energy depends primarily on the density of the material.
- At lower energies it depends mainly on the effective atomic number as well as the thickness of the material.
- Better than single energy; however, false alarm rate is roughly 20% due to confusion of material density.(volume measuring techniques needed)

Explosive Detection System(EDS)

- **The CTX 9000 DSi (InVision Technologies)**
- Worlds fastest EDS
- Proven effective in detecting explosives
- Based on computed tomography technology which operates like medical CAT
- Dual energy option possible,but not implemented.

The CTX 9000 DSi system is the world's fastest FAA-certified explosives detection system (EDS). FAA-certified at 542 bags per hour (operational modes yielding even higher throughputs).

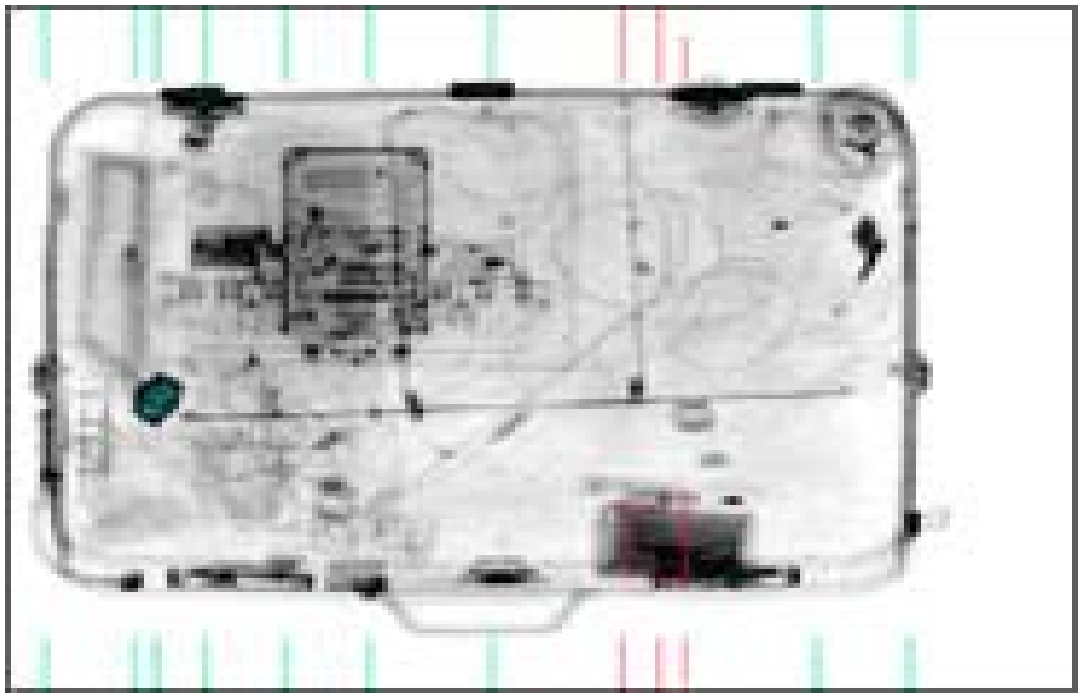
Installed in 90% of US airports

•Computer determines which areas need "slice" images, taken by the rotating X-ray source. (Operator can also direct CAT scans)

How it works

- Phase one: similar to conventional airport scan
- Phase two: CAT scans of suspicious areas to determine density, texture, mass and shape of object. (Gets missed sheet explosives)
- Since CT scan produces true cross section slices, it is able to identify objects that are surrounded by other materials or hidden by innocuous objects.

Alternative to X-rays



Could you spot the dangers in this monochromatic X-ray of a piece of luggage? Some say that hidden bombs and contraband could more easily be "sniffed out" using advanced neutron scanning techniques. (InVision/AP Photo)

Neutron Bomb Sniffer

Alternative to X-rays technology (market leader)

- The ***Cargo Inspector*** from Ancore (recently acquired by OSI Inc.)
- Promises better information about potential threats drugs and explosives
- Ancore claims faster and more effective than X-ray machine
- Size of car wash and costs $10 million
- Has tough critics in high places

How it Automatically Detects Drugs and Explosives

- Uses short burst of neutrons to produce gamma rays
- Gamma rays used to generate 3D images and nuclear signatures
- ATR software determines the components of specific materials

Future Bomb Sniffer in a Shoe Box

- Developed at Oak Ridge (Tenn.) National Laboratory to detect plastic explosives
- Based on microcantilevers that are used for detecting minute quantities of biological molecules such as DNA and proteins
- Thousand times more sensitive and cantilever costs about a dollar
- See *Science News*, 23 Aug. 03, Vol. 164, p116

How It Works

- Microcantilever surface is coated with layer of gold and then a one-atom thick layer of acid that normally binds to PETN and RDX
- When molecules bind to acid they cause coat to stretch and bend surface in proportion to amount of binding
- Laser detects the amount of curvature in the cantilever

See *Science News*, 23 Aug. 03, Vol. 164, p116

Entry Point Screening

- The Entry Point Screening Program is a comprehensive program focuses on new technologies for screening vehicles, cargo, and mail.
- The **primary concern is large vehicle bombs** followed by detection of chemical, biological, and radiological weapons.
- Examples given here of multiple alternative technologies using X-rays and gamma rays.

Cargo Container Statistics
Scope of Problem

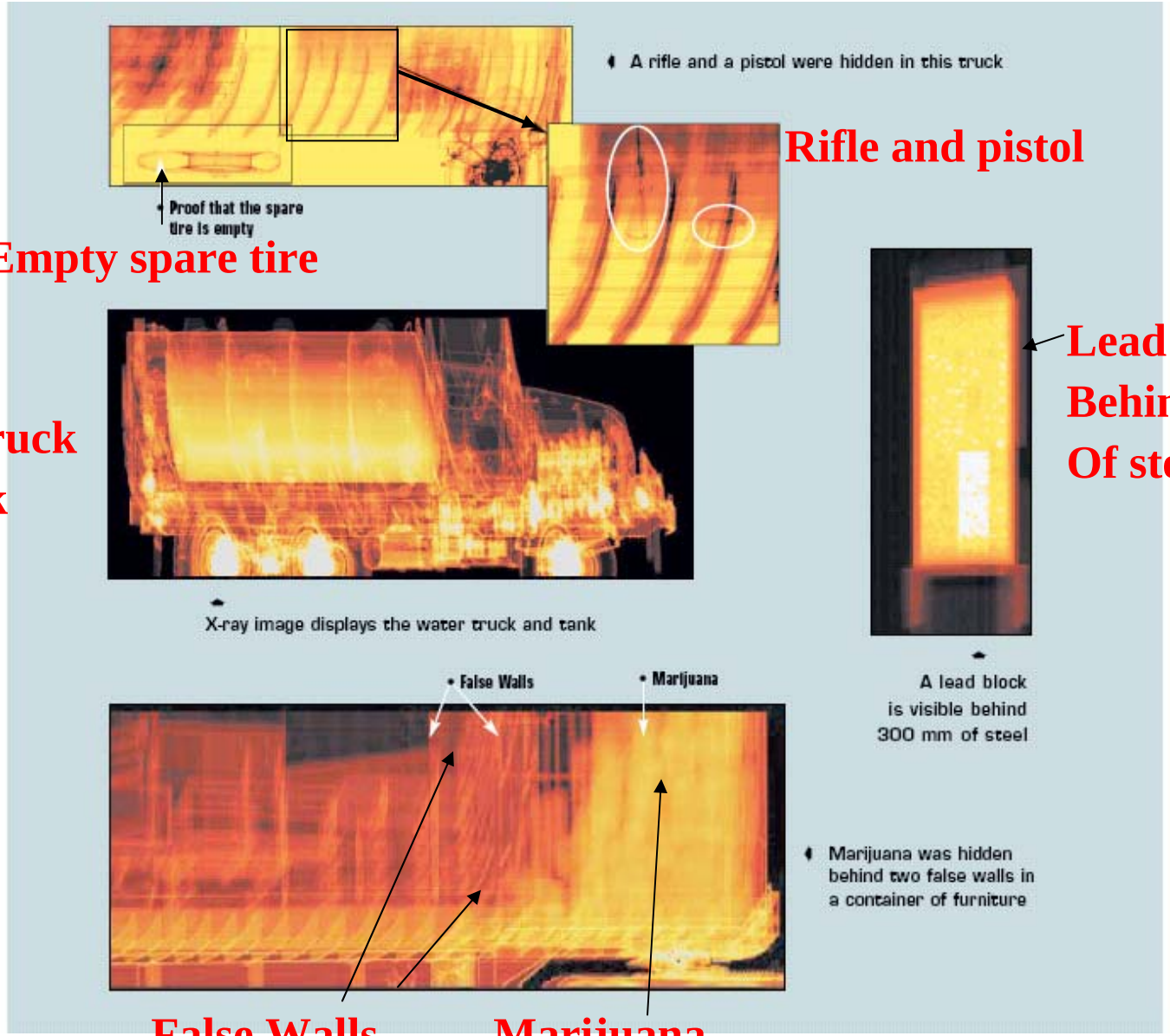
- On a yearly basis, more than 17 million containers arrive by ship, truck, and rail. In 2001, Customs processed more than 214,000 vessels and 5.7 million sea containers. (mostly near major centers)
- Each container has the potential to conceal a dirty bomb or a bio-chemical weapon and yet < 2% are opened and inspected.

Entry Point Screening

ARACOR's *Eagle*™

- The Eagle can be used to rapidly inspect cargo at entrances to military bases, government offices, and critical facilities, such as nuclear power plants.
- The Eagle is the only system capable of inspecting fluid-filled trucks, such as those used to destroy US embassies and barracks overseas. *(ARACOR)*

ARACOR's Eagle X-ray System

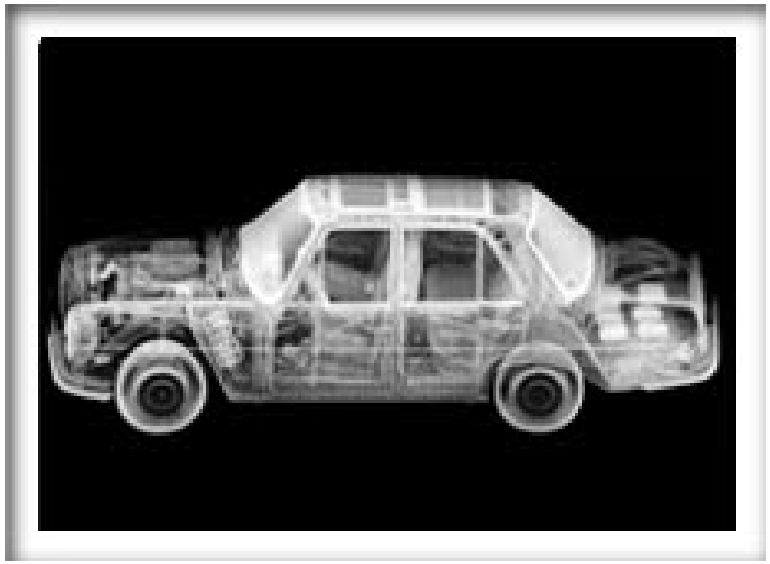


X-Ray Cargo Detection System

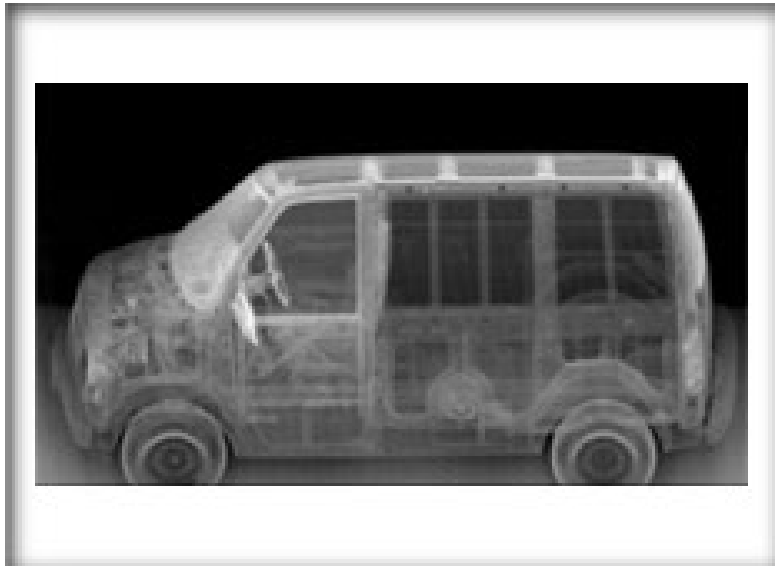
Global Security Solutions' MobilSearch™

- MobileSearch is a truck-mounted mobile back-scatter X-ray detection system that can be used for inspecting containers, vehicles, or any large item where mobility is necessary.
- Several MobileSearch units are in use along the U.S.-Mexico border and overseas.

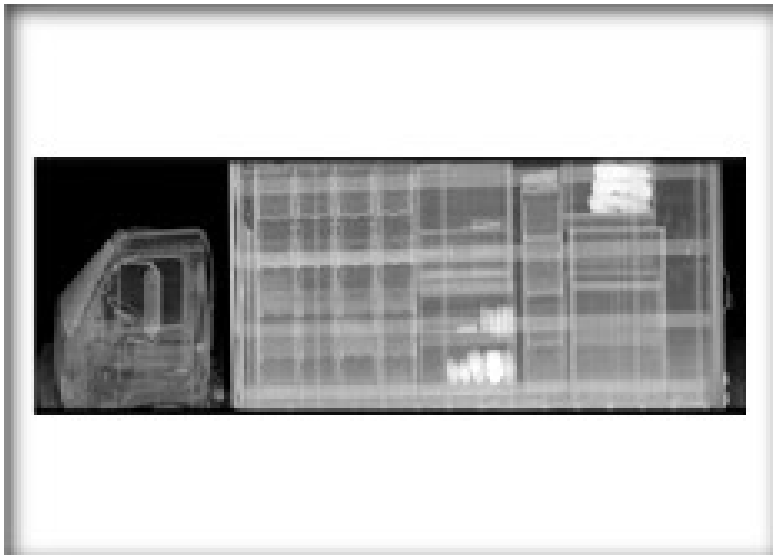
MobileSearch system in action, scanning a truckload of TV monitors



MobileSearch Backscatter X-ray image of a car with cocaine simulant in trunk.



Backscatter image of AS&E van scanned with MobileSearch



Backscatter image of truck scanned with MobileSearch

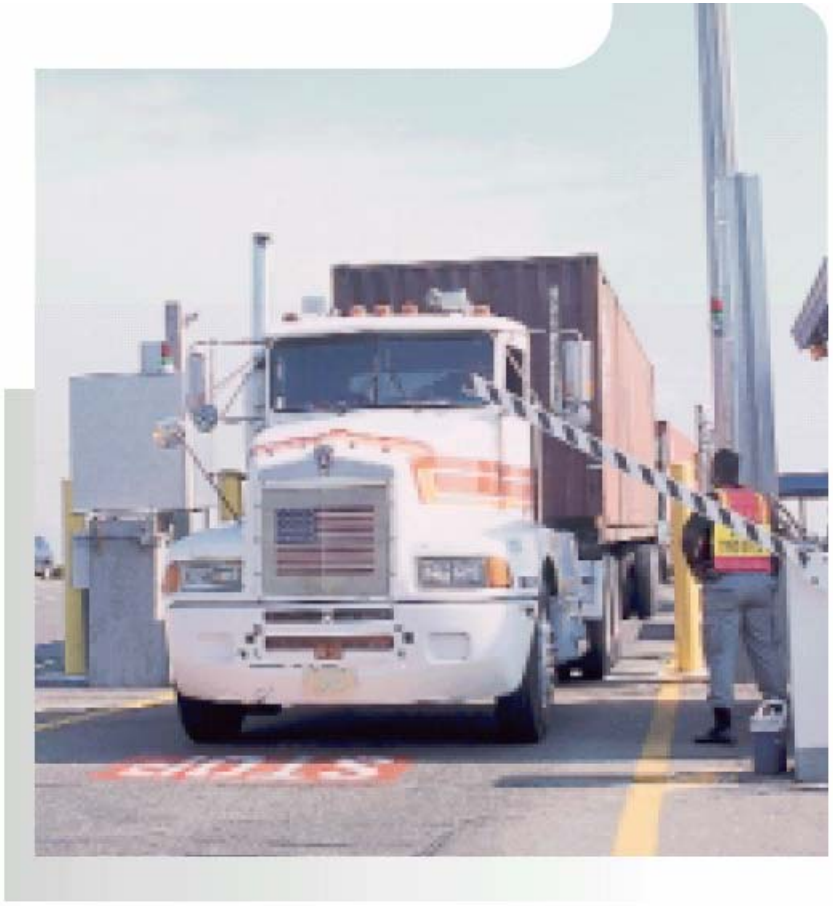
Gamma Ray Technology

SAIC's VACIS™

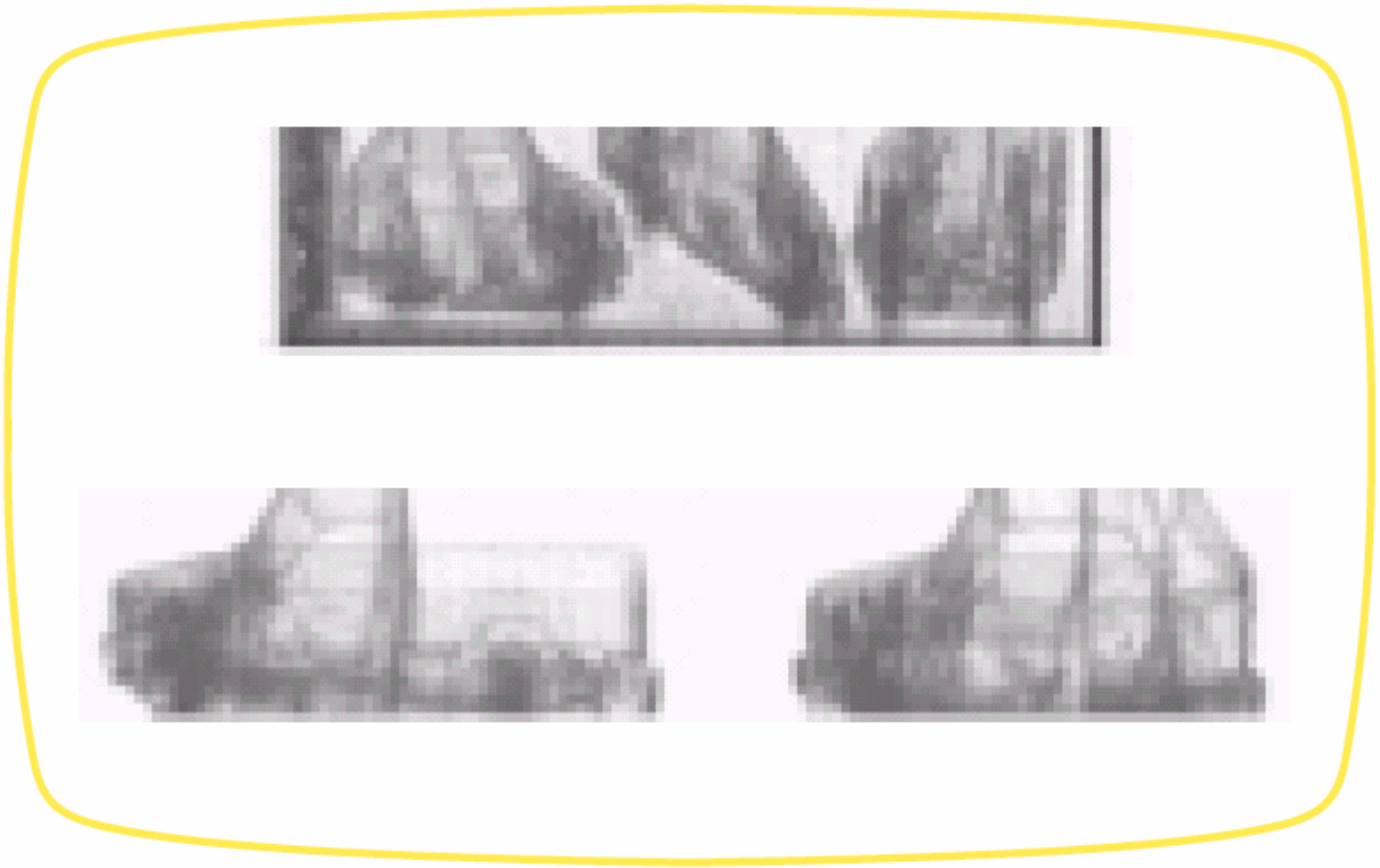
- SAIC is major company in this technology
  - Vehicle and Cargo Inspection Systems (VACIS) utilizes Cesium-137 or Cobalt-60 radioisotope
- Compare to X-ray technology
  - Less expensive and easier to maintain
  - Moderate dose emitter and greater penetration
  - Easier to use
  - Higher throughput

Portal VACIS

- For port gates and roadways
- Each year thousands of cars are concealed in cargo containers and exported via seaports and border crossing

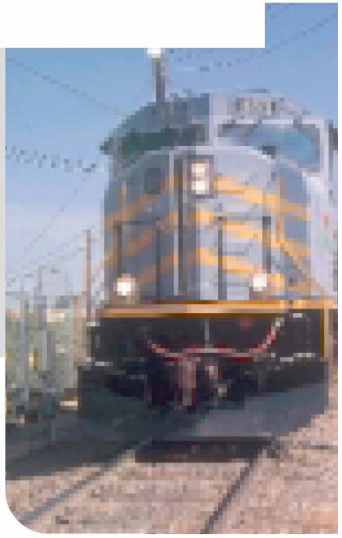


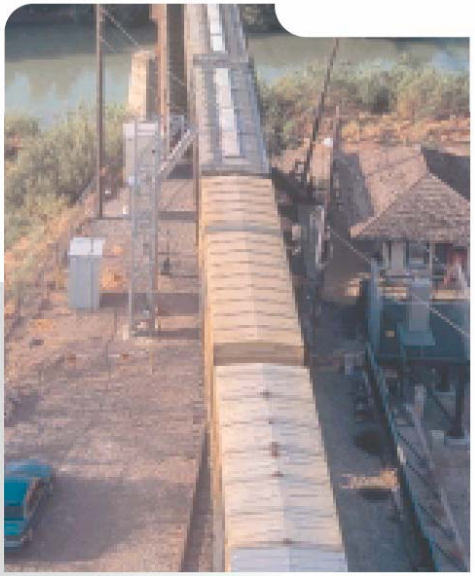
Portal VACIS



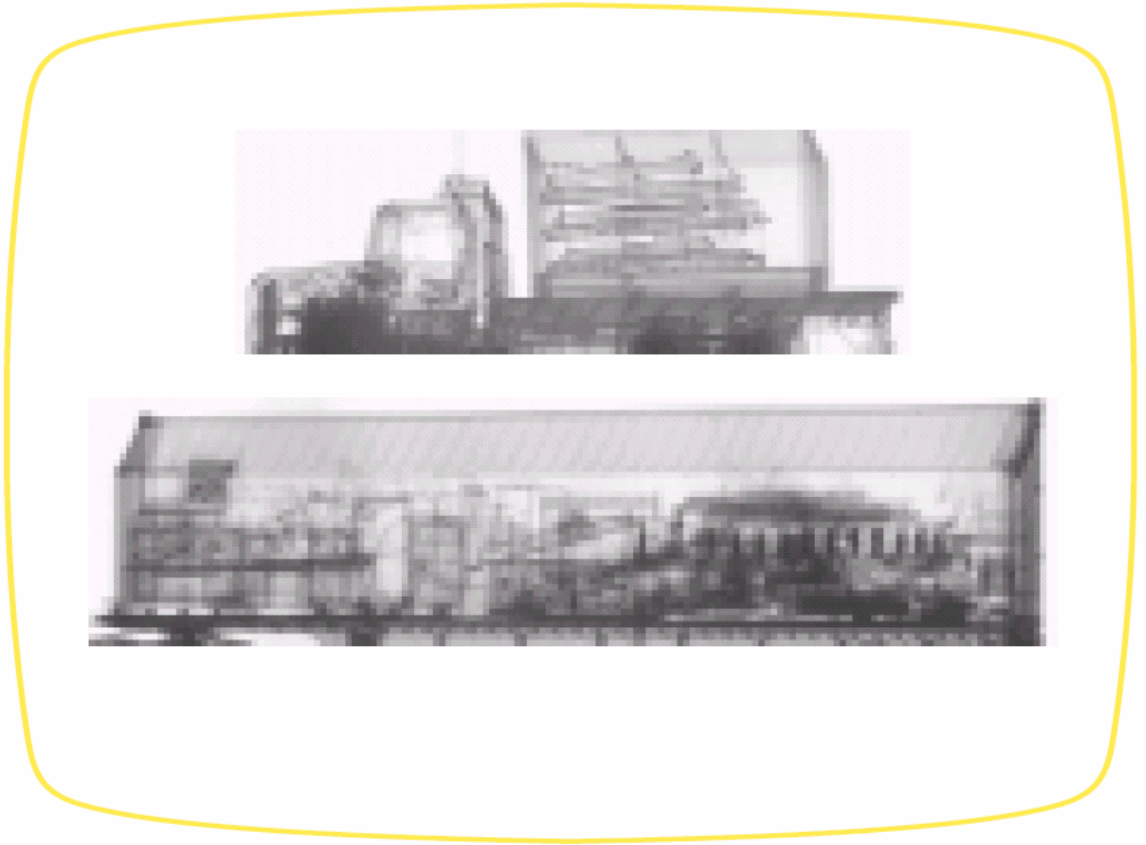
Portal VACIS's configured here to detect stolen cars concealed in cargo containers.

Railroad VAICS

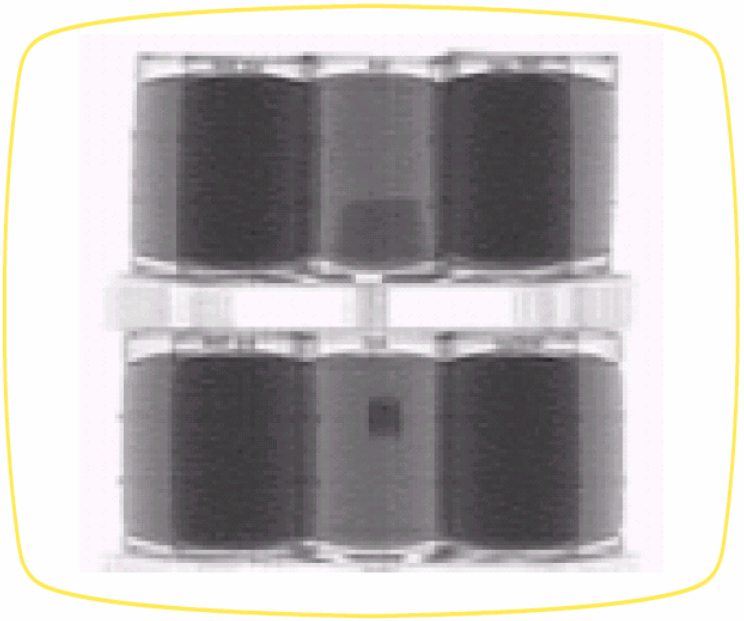




Mobile VAICS



Pallet VACIS



ATR Research

- Several areas that exemplify state-of-art and future direction
  - Robot Security Guards
  - Traffic Monitoring
- Research areas involve
  - Distributed camera systems
  - Dynamics and higher order scene descriptions

Real-time Video Intelligence and Automated Monitoring

- Vastly enhances security systems
  - Access control
  - Intrusion detection
  - Perimeter monitoring
- Identifies *inconsistencies and abnormalities*
  - Environment and human behavior
  - Movements of people, vehicles and objects

Robot Cameras Systems Based on Actions and Personality

- Teach computers *"acceptable" and "unacceptable"* patterns of behavior
- Developed software able to anticipate if someone is about to mug an old lady or plant a bomb at an airport
- And if it decides that your actions are "undesirable" it can send a warning signal to a security guard or police officer

Future Robot Security Guards

- At Kingston University in London, scientists claim to have developed software, called Cromatica, that can mathematically work out what is likely to happen next.
- It exams CCTV images and compares them to pre-programmed behavioral patterns
- Creator, Dr. Velastin admits *"we are still a long way off from machines replacing humans."*

July 25, 2002 DOJgov.net newswire
FARNBOROUGH, England

Some indication that public cameras displace crime out of the lens view

- Sydney, Australia: $1-million public camera system accounted for an average of only one arrest every 160 days.

- A face recognition system in Tampa, Fla., failed to identify any individuals in the police database of photos and misidentified some innocents as suspects.

Traffic Monitoring Example

- Video cameras are programmed to *detect anomalies* in traffic patterns
- Cameras tracks a erratic vehicle
- Camera data relayed to ATR computer
- Vehicle identified as one likely to be hostile
- An alarm is then issued

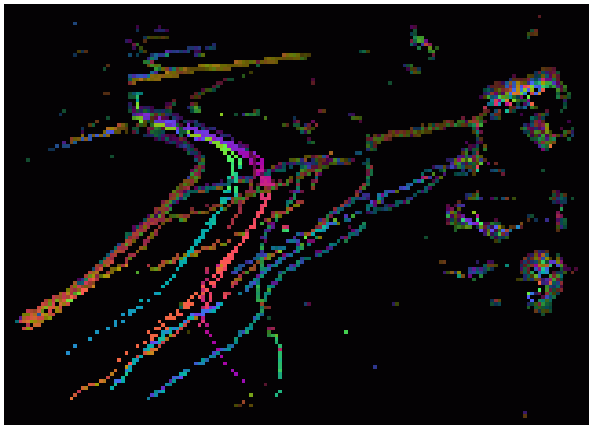
A Forest of Sensors – Tracking

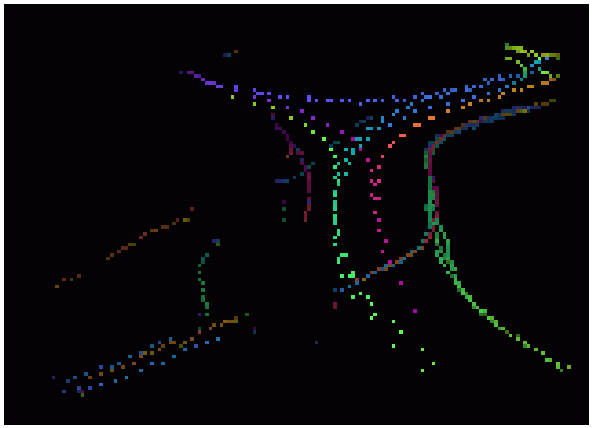
Chris Stauffer, MIT AI Lab

http://www.ai.mit.edu/projects/vsam/

- Faster computers enabled researchers to model real world dynamic processes.
- Finding correspondence is key problem.
- A robust system should **not** depend on:
  - Careful placement of cameras
  - Background variations such as lighting changes, clutter motion (e.g.\ swaying trees) and slow-moving objects

Input





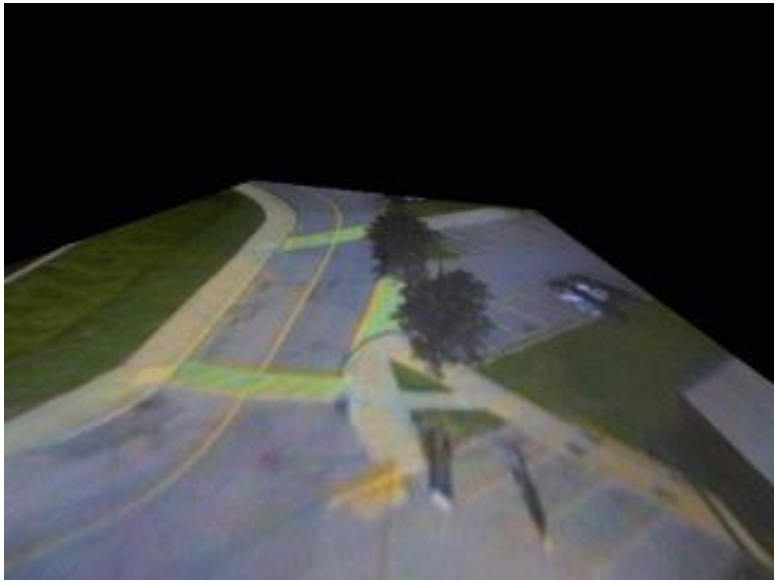
Example: two views from opposite sides of a parking lot and 10 minutes of tracking data.

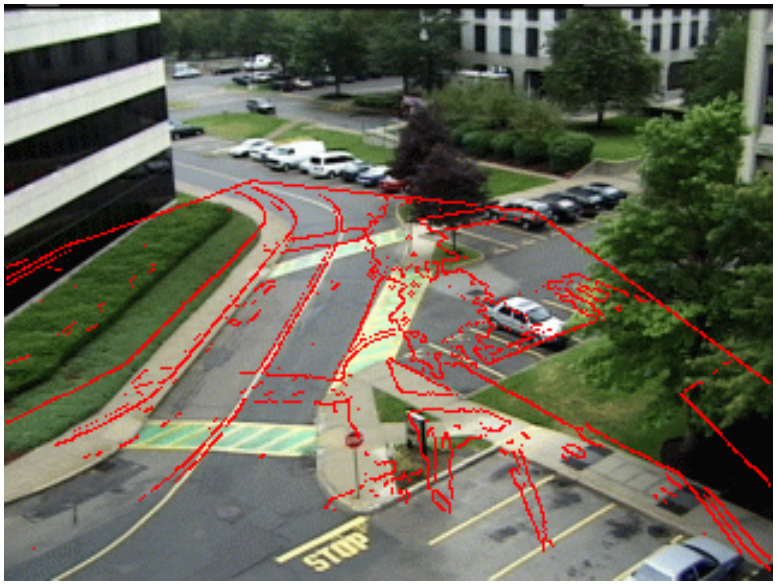
Each frame: (x,y) and time stamp of moving object.

Objects are linked over multiple frame by a *unique ID*.

Courtesy: Chris Stauffer, MIT AI Lab

Rough Alignment Using Moving Objects

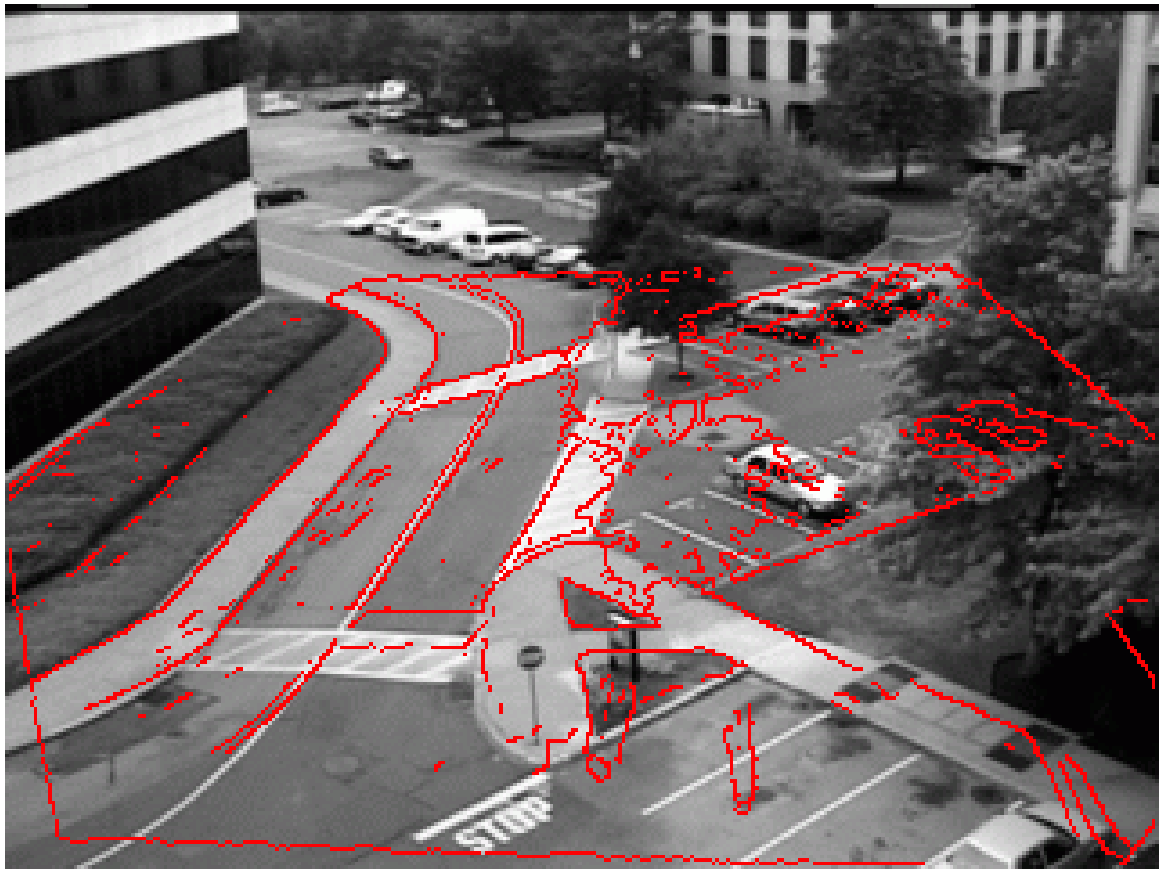




Note the residual alignment errors in overlay edges mainly because tract objects are above ground.

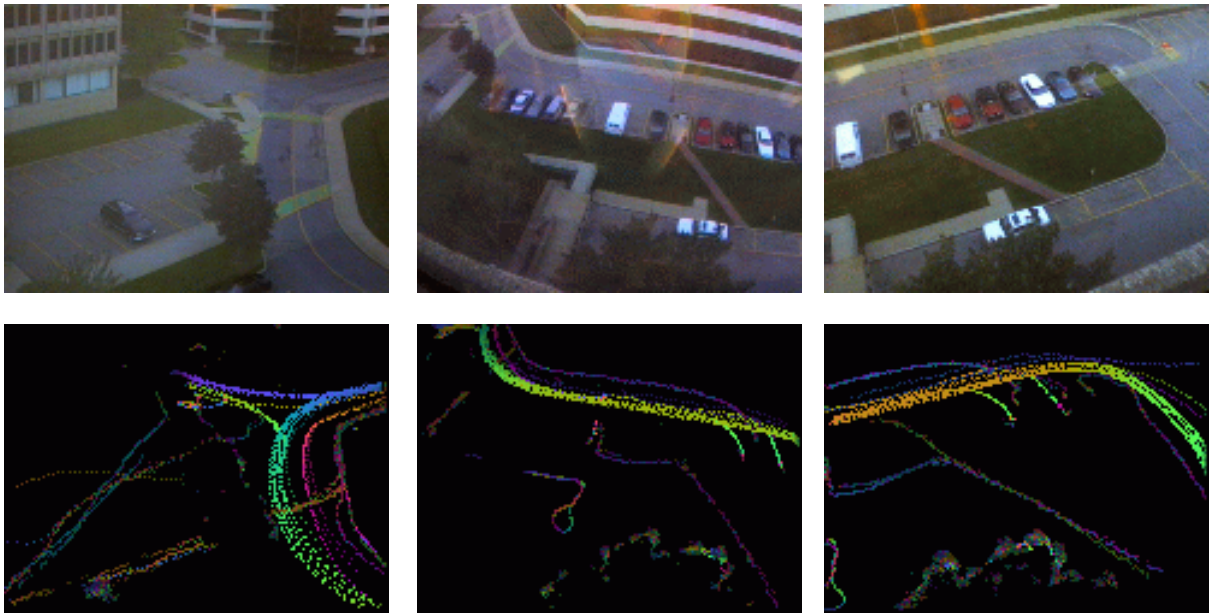
Courtesy: Chris Stauffer, MIT AI Lab

Fine alignment using static features on the ground



Courtesy: Chris Stauffer, MIT AI Lab

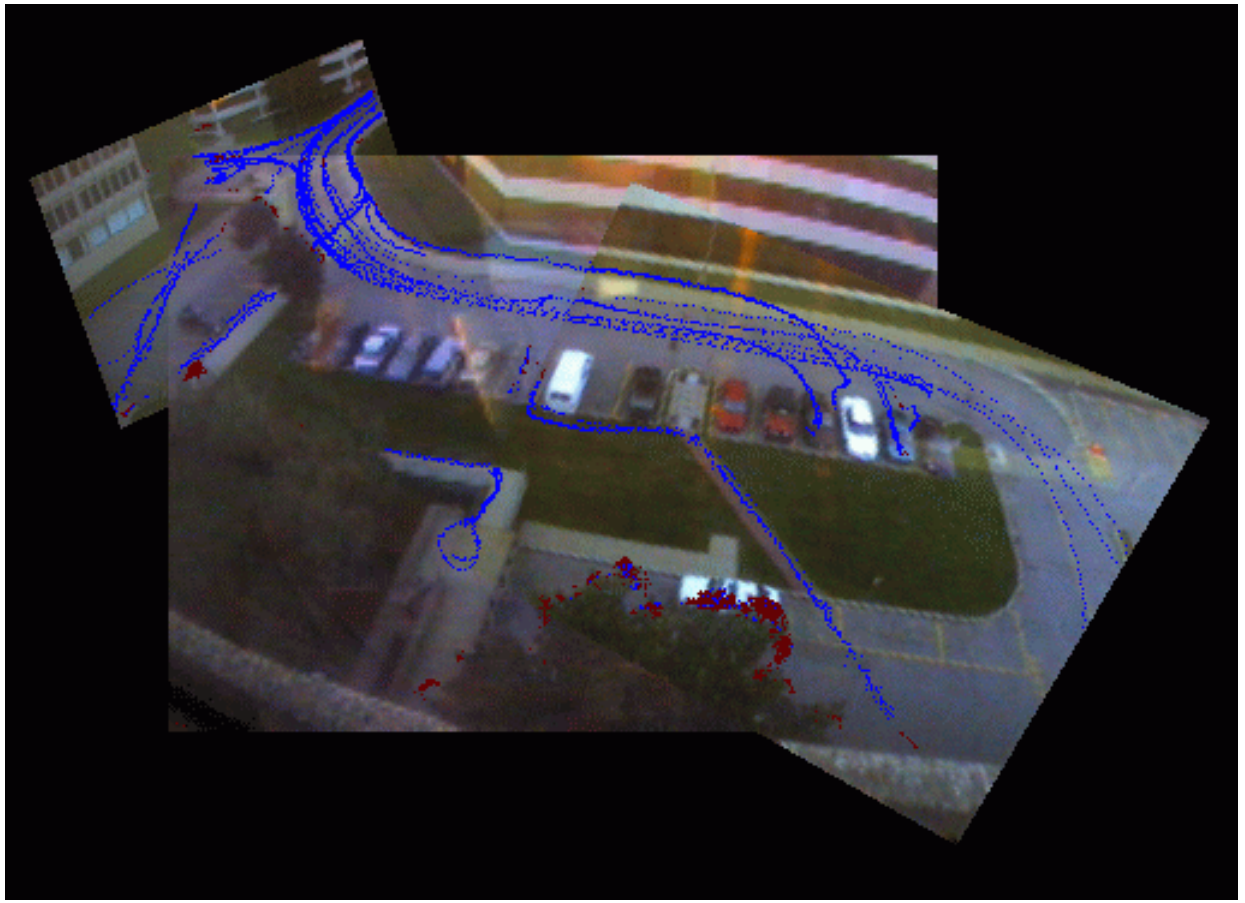
Activity Monitoring



Use tracking data from 3 multiple views to perform geometric alignment of the images and the tracks.

Courtesy: Chris Stauffer, MIT AI Lab

Activity Monitoring



After geometric alignment of the tracks we can combine tracks from multiple views into a single track.

Courtesy: Chris Stauffer, MIT AI Lab

Spatial-temporal Processing

- The foundation of future ATR systems is detection, tracking, and correlation of specific image features.
- This requires good registration and fusion algorithms, multi-sensor recognition algorithms, and auto-calibration procedures.

Summary

Example	Automation	Environment	Level	Technology
MSTAR	H	clear & conceal.	ATR	SAR
Biometrics				
Most Examples	H	controlled	PR	images
Facial Recog.	H	remote	ATR	video
Border/Trans				
People	L	controlled/ conceal.	HO	X-ray, Radio
Bag. (explosives)	L	controlled/ conceal.	HO	CAT, neutron*
Cargo	L	controlled/ conceal.	HO	X-ray,gamma
Behavior Monitoring	L	remote	HO	video
Traffic Monitoring	H	controlled	ATR	video

*** Nuclear and chemical signatures are technologies that lend themselves to automation in contrast to image dependent approaches such as Xrays that are currently heavily dependent on human operators (HO).**

ATR Research

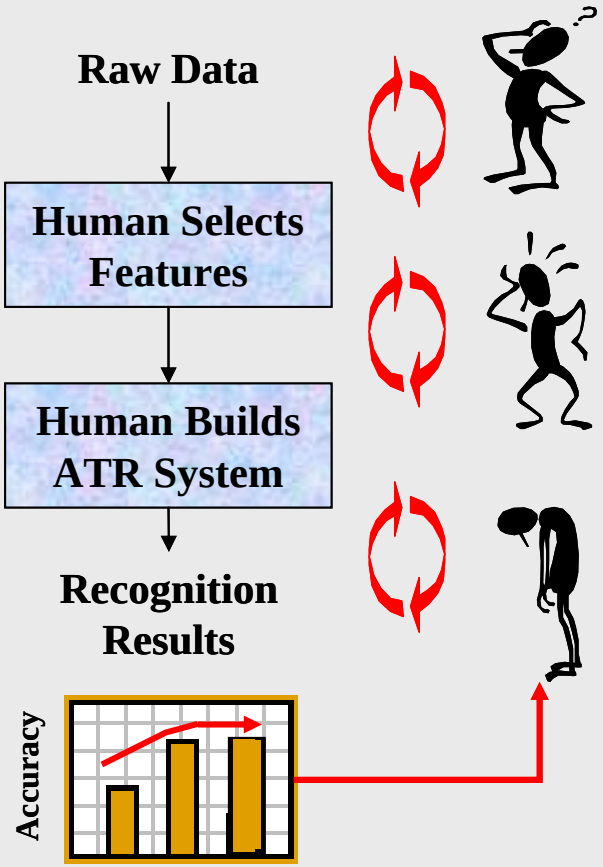
- There is a need for ATR in the examples that depend on human operators
- ATR is still a relatively young field
- R&D is complex and expensive
  - MSTAR: multimillion dollar project involving over 12 corporations and universities
- Advances in developing automated systems has been relatively slow

Conclusion

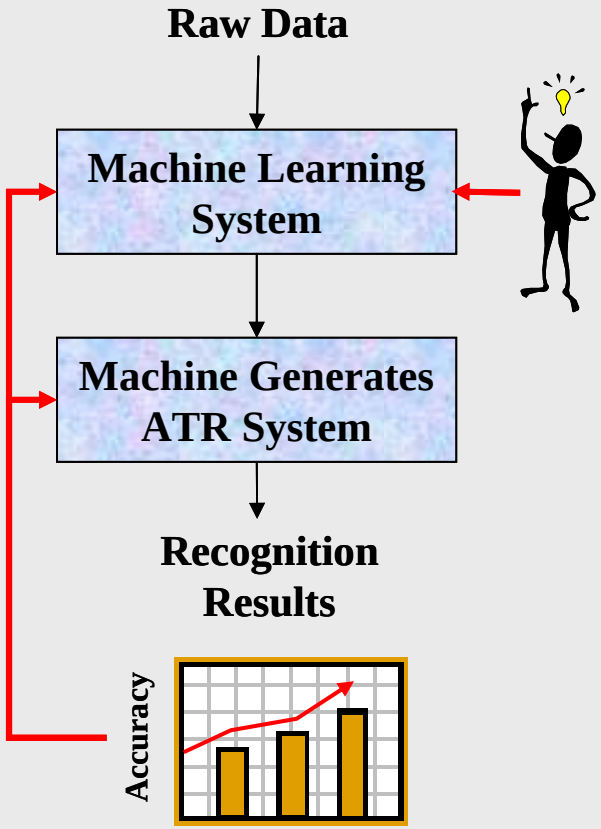
- 2003 budget allocates $37.7 billion to HS
- This should advance ATR research
- ATR will play a major role in both military and domestic defense.
- Hard to forecast full impact of ATR technology on Homeland Security
- Comprehensive computer vision solutions may be a long way off.

Approaches to ATR Design

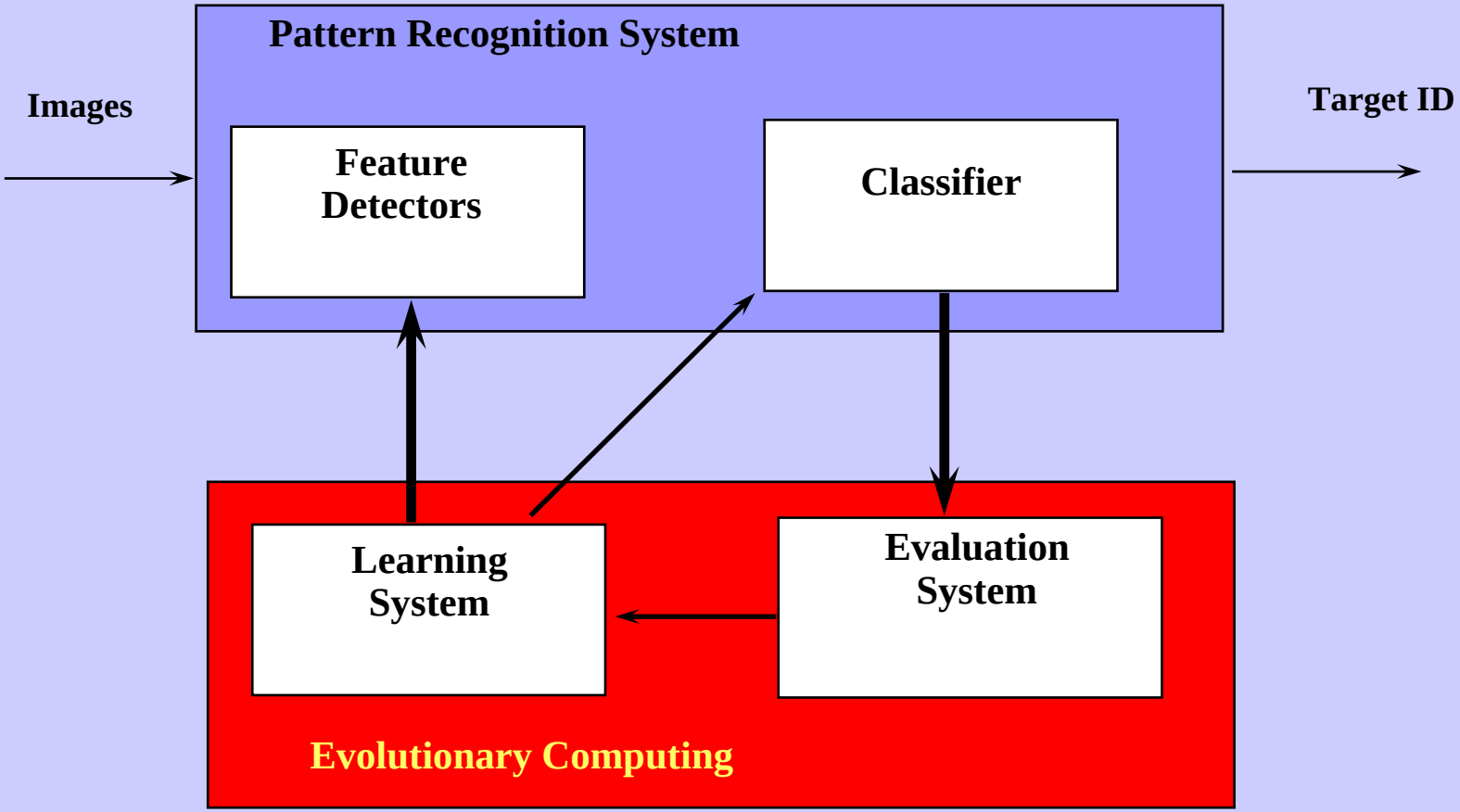
Current



Future



Hybrid Evolutionary Learning for Pattern Recognition -HELPR



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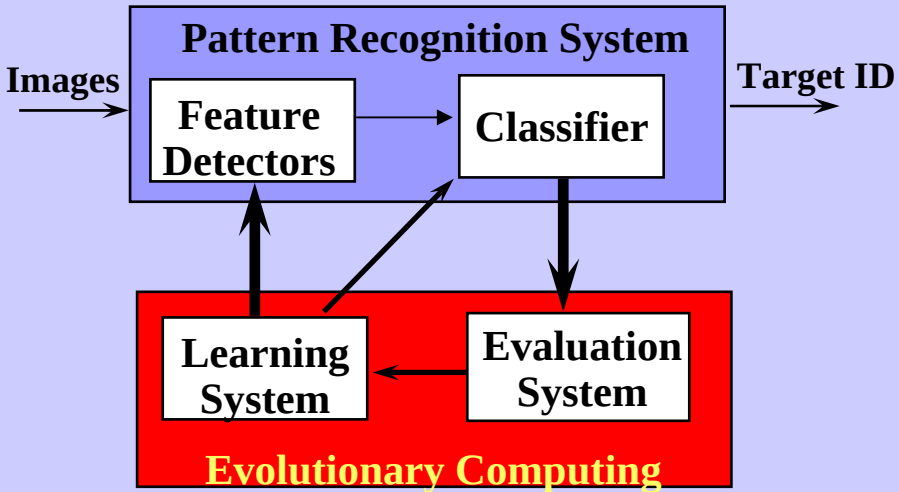


Objectives

- Develop technology necessary to automate design and synthesis of pattern recognition solutions that would otherwise be manually developed by human experts.
- Develop discovery algorithms to grow and optimize neural networks, morphological and other processing networks.

Approach

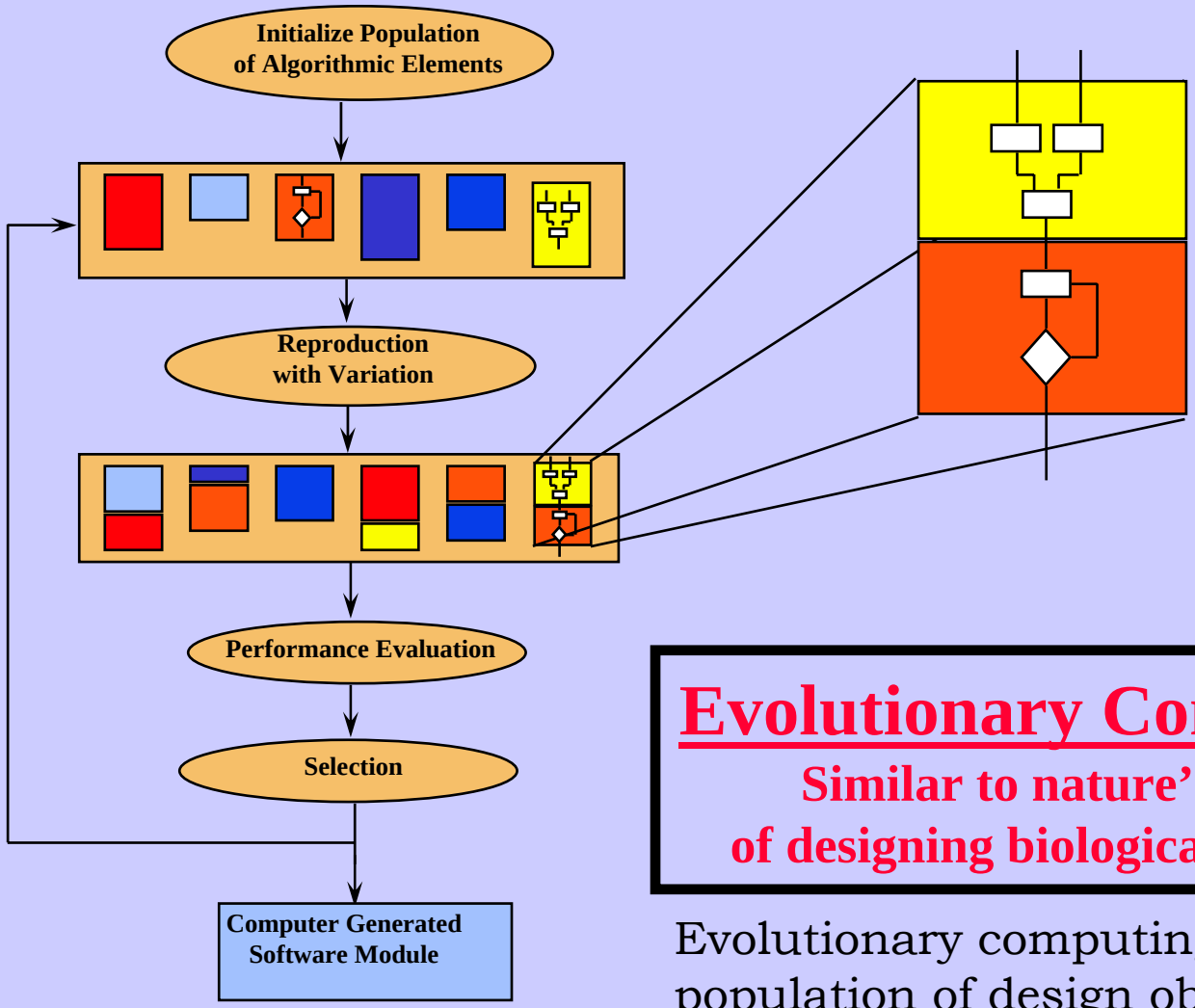
•Hybrid automatic design system that combines a multiplicity of evolutionary computation and learning algorithms.

•Computer simulation experiments to generate feature detectors and classifier

•Collaboration: Wright State University, Miami University, Univ.of Dayton, AFRL

Payoffs

- Enhanced ATR recognition systems.
- Reduced need for human expertise.
- Deceased development time.
- Reduce development costs.
- Exploit massively parallel computers.
- New and unconventional solutions

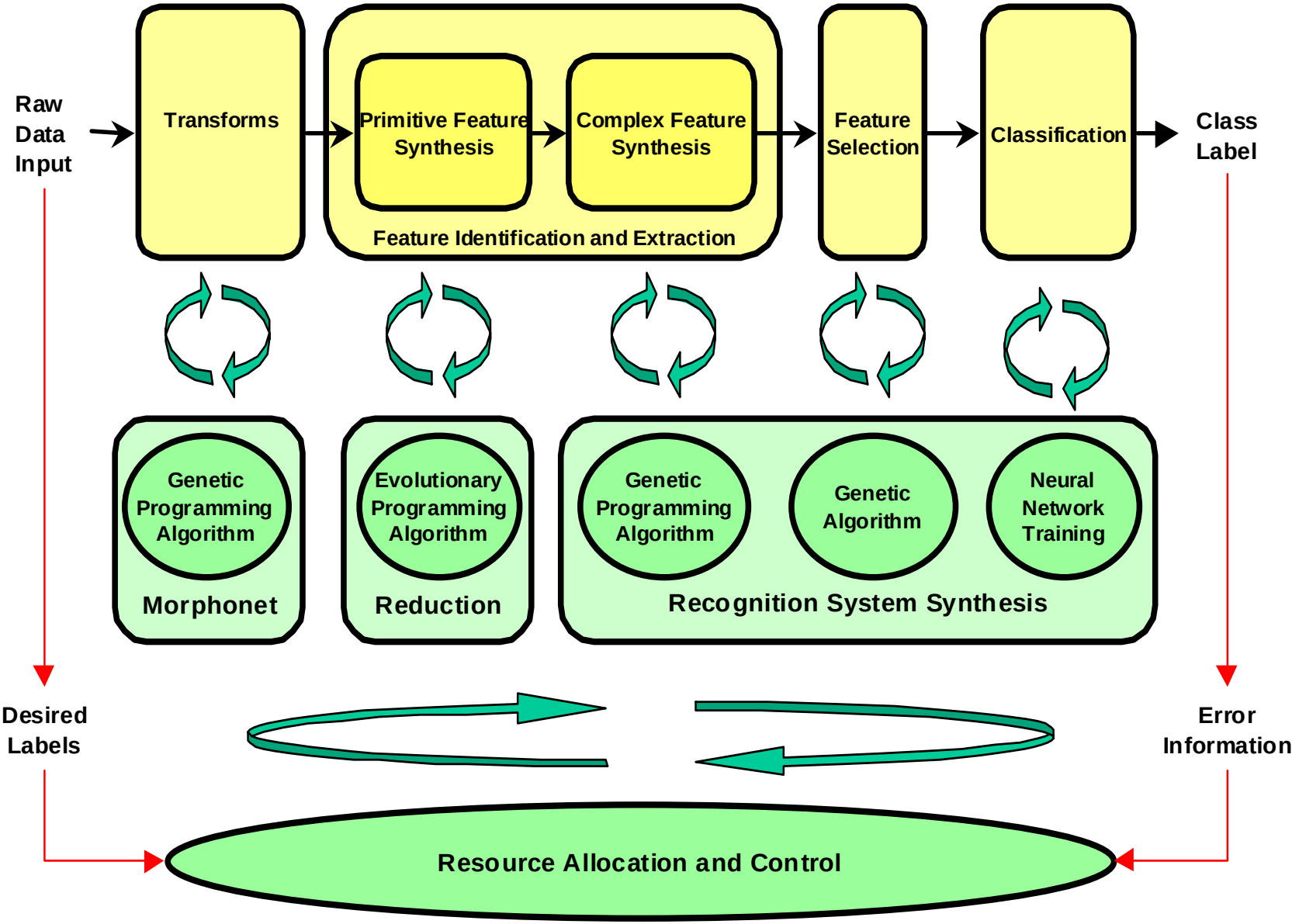


Evolutionary Computing

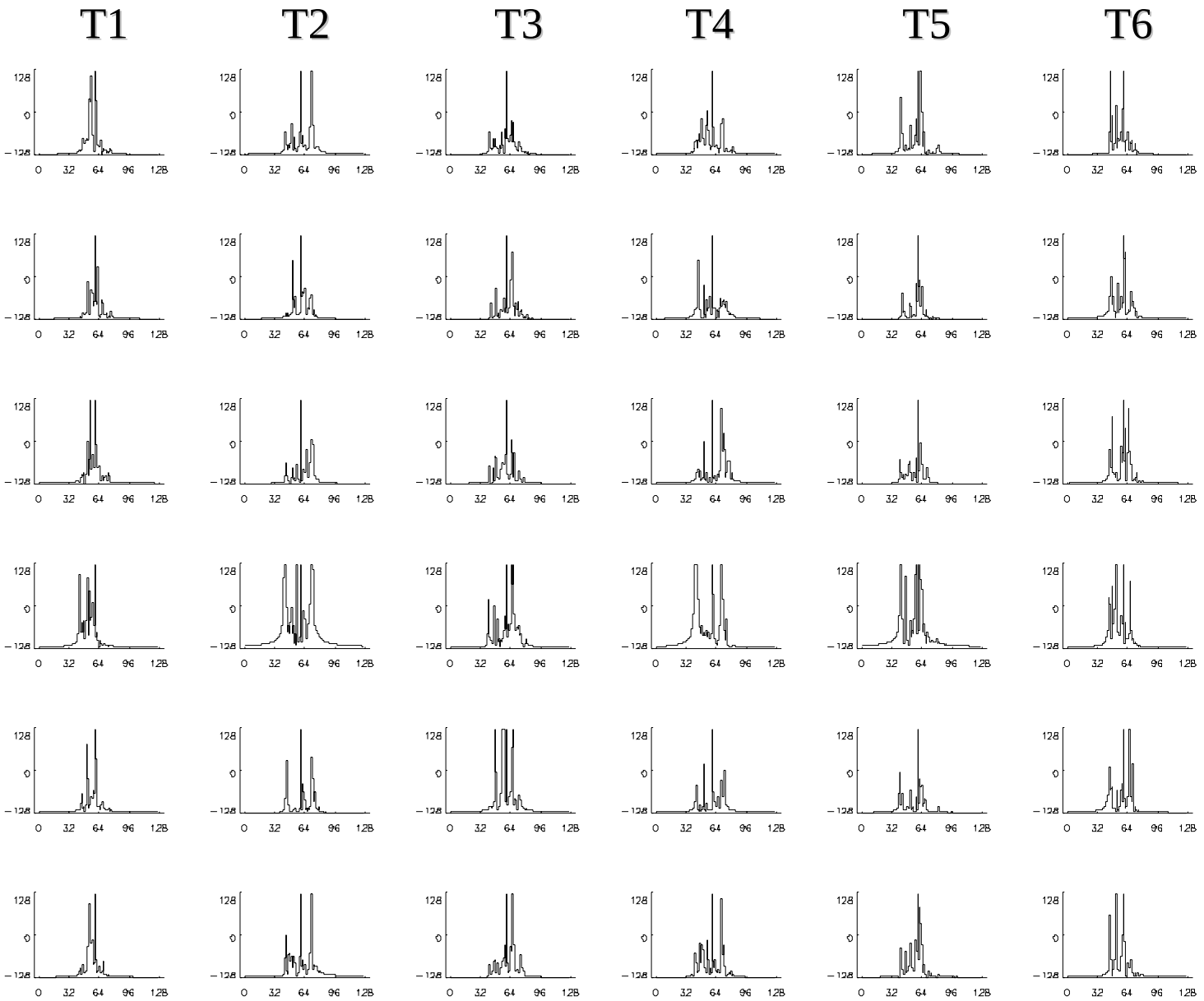
Similar to nature's way of designing biological systems

Evolutionary computing subjects a population of design objects to a process of reproduction with variation driven by the performance measures.

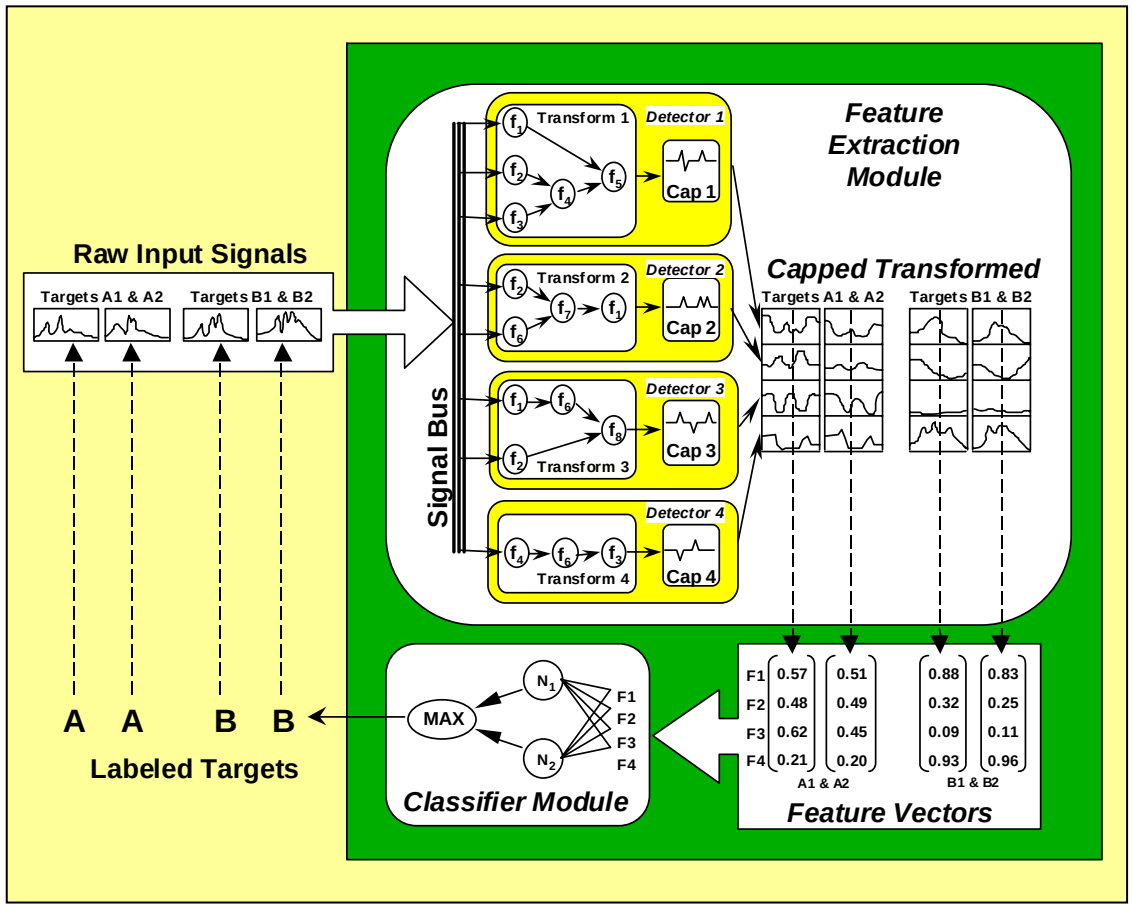
HELPR Concept



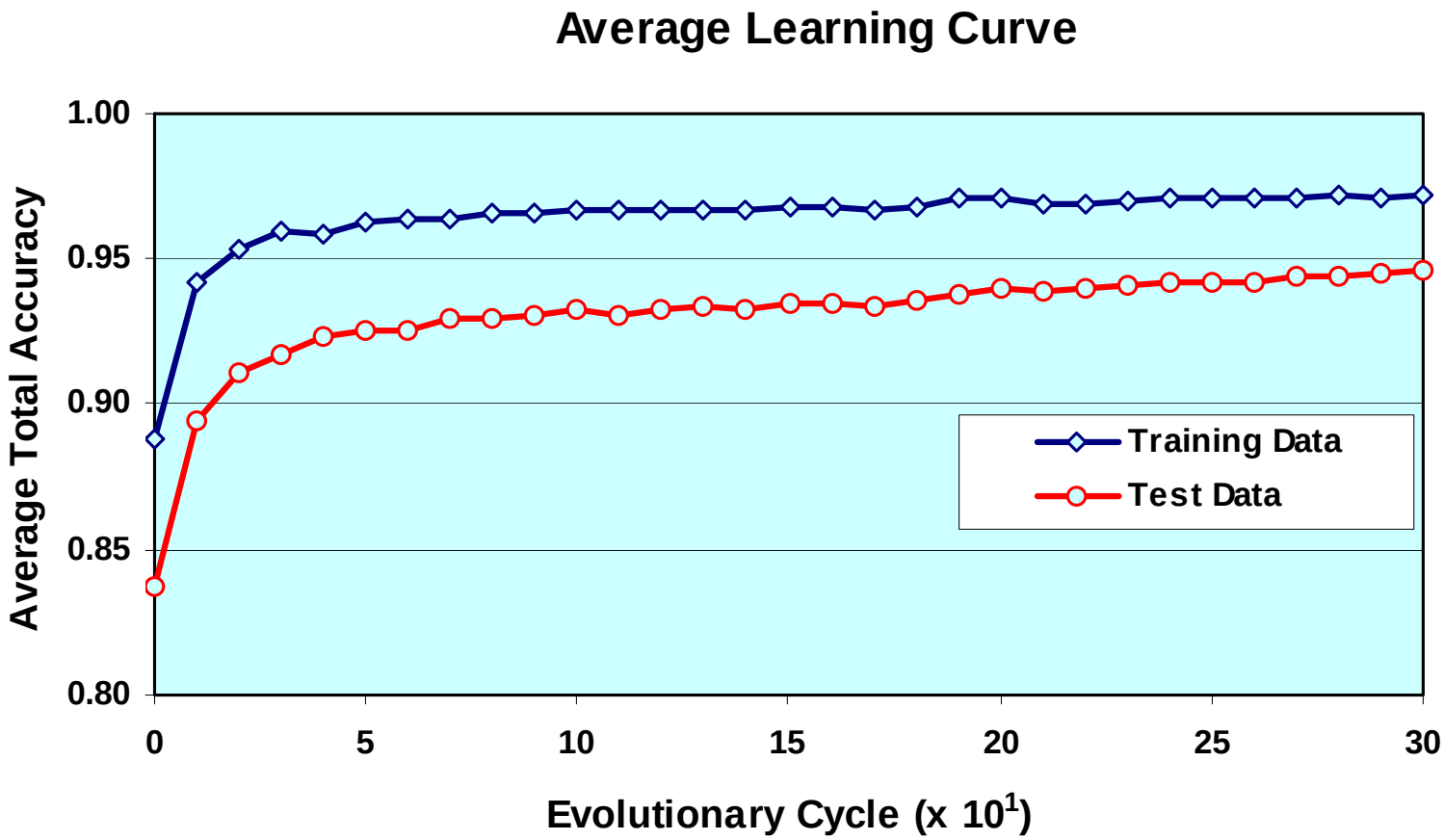
Sample Training Signals

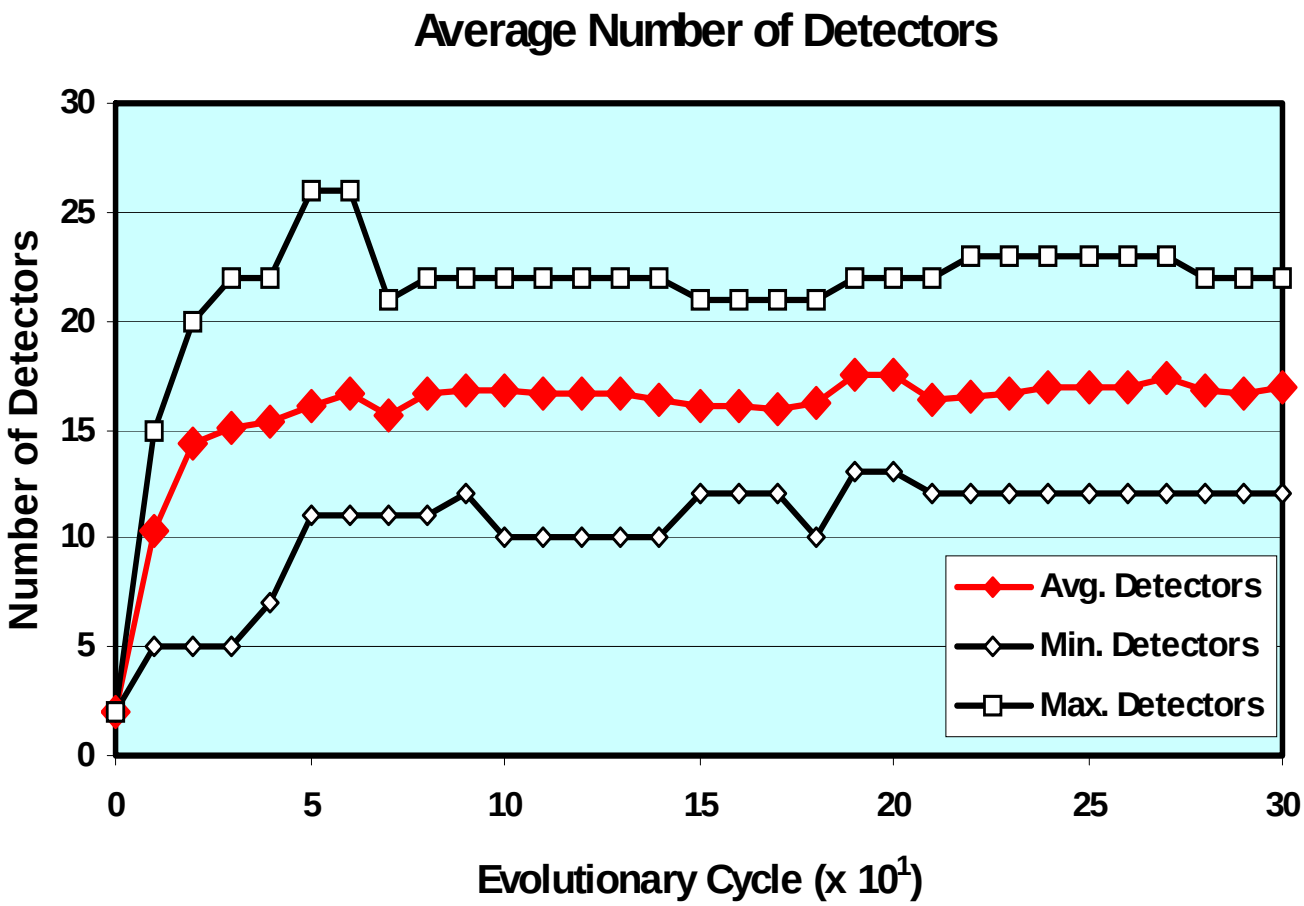


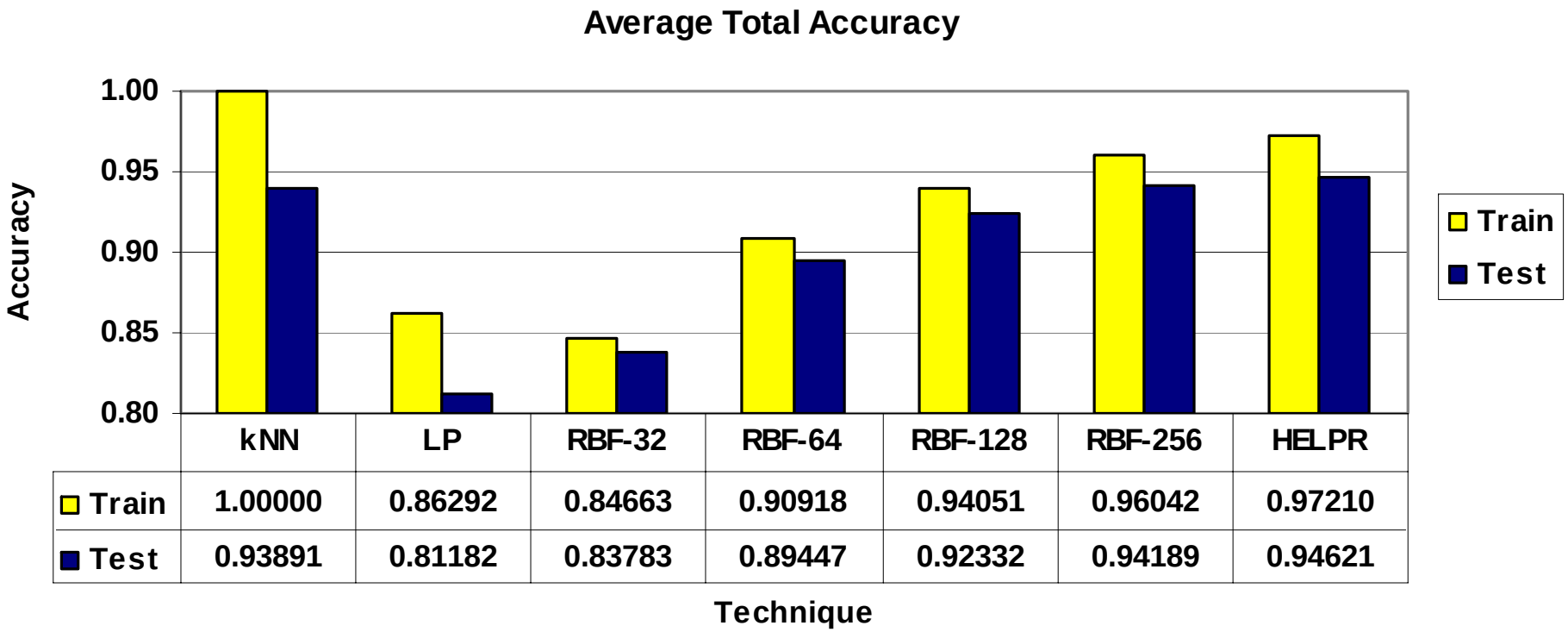
An evolved pattern recognition system



- Morphological / arithmetic features are evolve using GP
- Feature sets are selected using GA
- Sets of feature vectors are classified using a LP
- The final PR system consists of sets of transforms and parameters


Average Learning Curve
Average Total Accuracy
1.00
0.95
0.90
0.85
0.80
0
5
10
15
20
25
30
Evolutionary Cycle (x 10^1)
Training Data
Test Data


Average Number of Detectors
Number of Detectors
30
25
20
15
10
5
0
0
5
10
15
20
25
30
Evolutionary Cycle (x 10[1])
Avg. Detectors
Min. Detectors
Max. Detectors



	kNN	LP	RBF-32	RBF-64	RBF-128	RBF-256	HELPR
Train	1.00000	0.86292	0.84663	0.90918	0.94051	0.96042	0.97210
Test	0.93891	0.81182	0.83783	0.89447	0.92332	0.94189	0.94621

Thank You