

Challenge Problems

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**National Institute of
Standards and Technology**



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Problem Definition

- Frontal Faces
- One Face Image per Person

Problem 1: Controlled Studio Environment



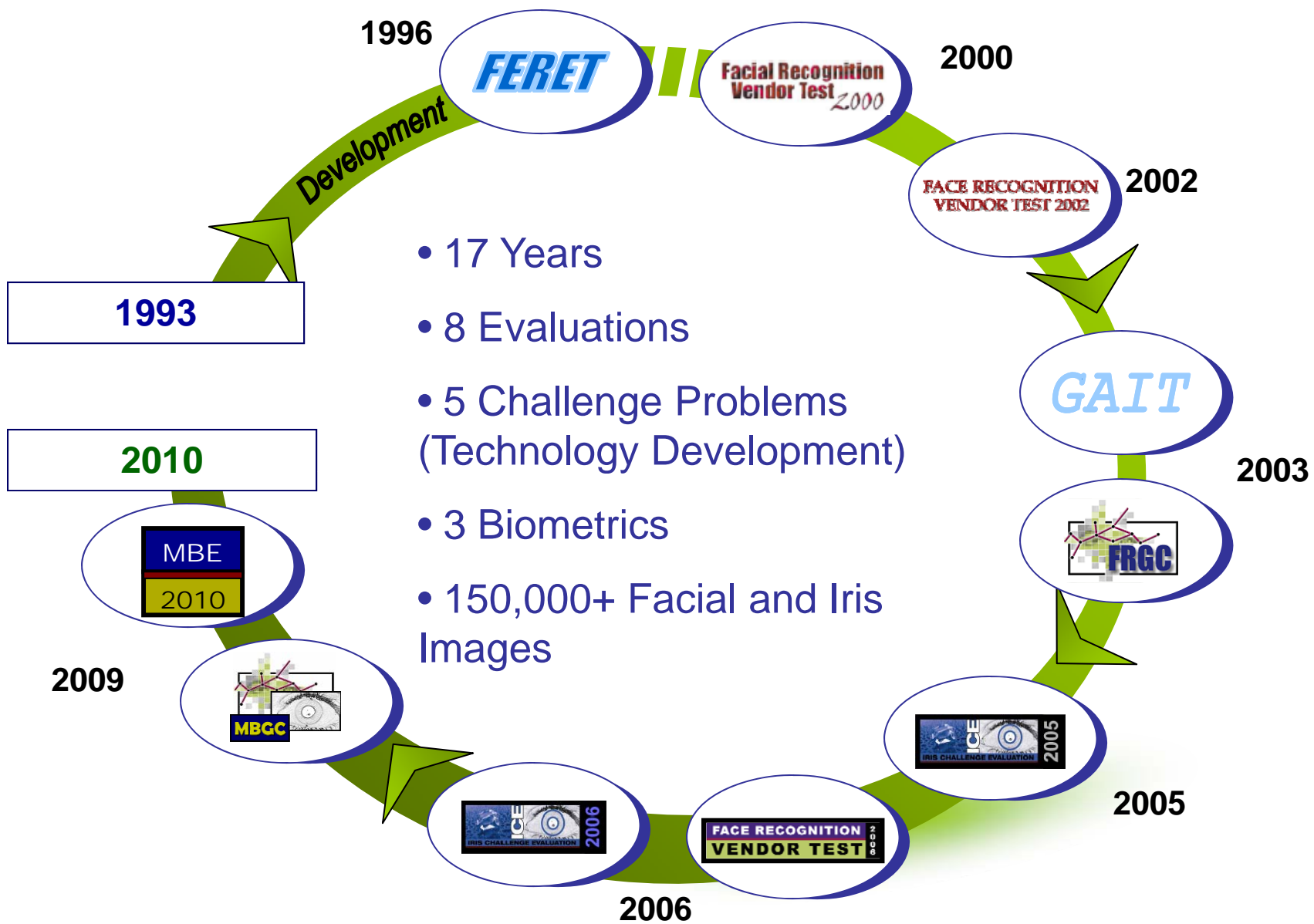
Problem 2: Studio vs. Ambient Lighting



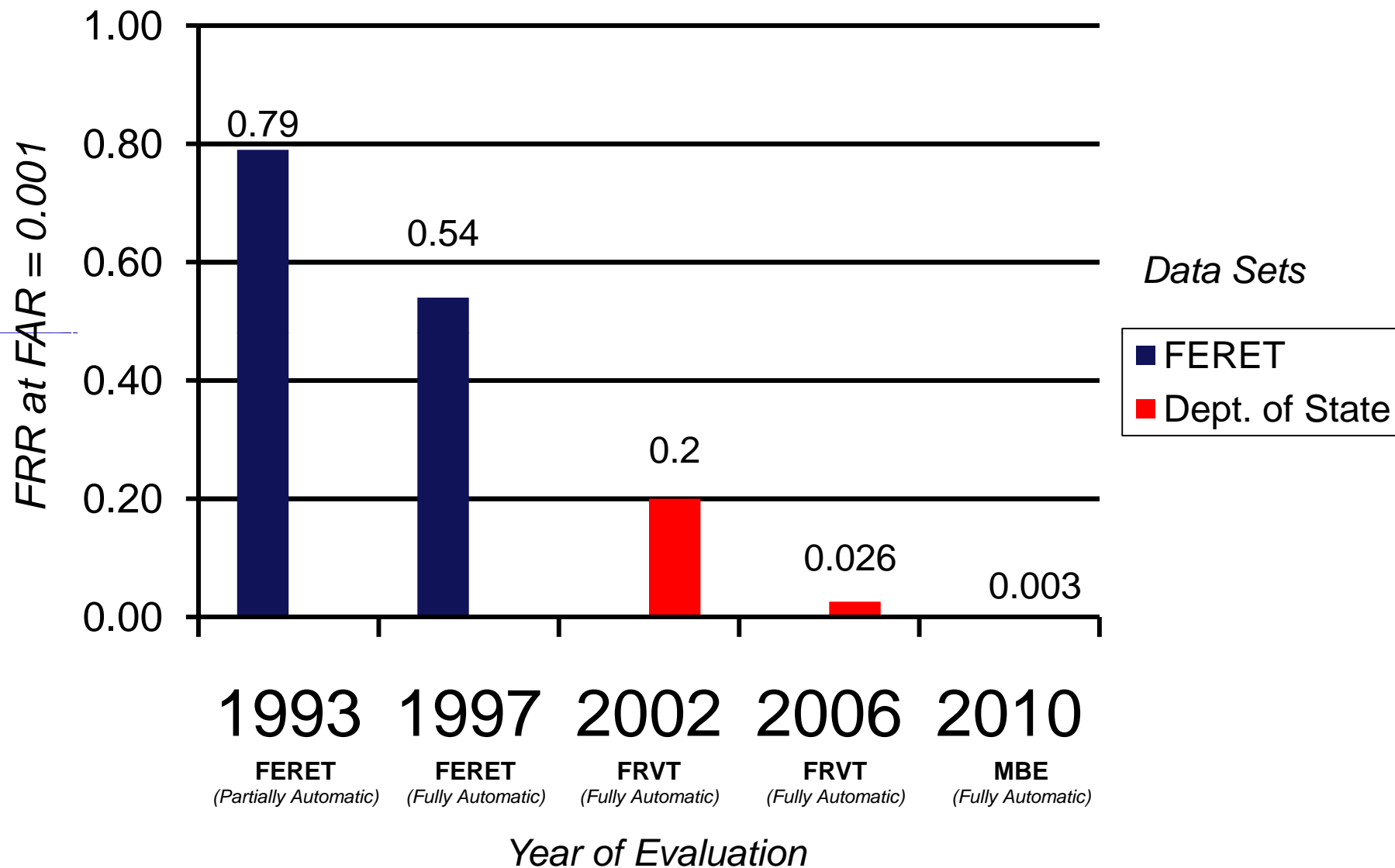
or



Technology Progress



From FERET to MBE 2010



Challenge Problems

- What are challenge problems?
 - A series of experiments designed to advance a technology's state-of-the-art
 - Experiments designed
 - Experiments and test data distributed to researchers
 - Researchers complete experiments and submit results
 - Scores are consolidated and reported
 - Introduction of new technology
 - Not an independent evaluation
 - NO sequestered data



What Is An Independent Evaluation?

- Independent assessment of performance by a third party
- Algorithms submitted to tester
- Algorithms are tested on sequestered data
- Results scored by tester
- Provides snapshot of current technology state-of-the-art

Advancing Technology and Methodology

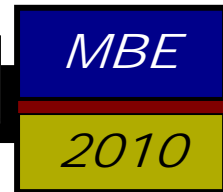
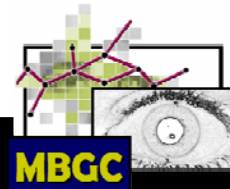
Programatics

Data
Collection

Challenge
Problems

Evaluations

Technology



Experimental
Design

Statistical
Analysis

Human
Vs
Computer

Methodology

NIST

Methodological Progress

1994: First Modern Technology Evaluation

2001: Re-sampling Techniques



1993

FERET

1996

Facial Recognition Vendor Test 2000

2000

FACE RECOGNITION VENDOR TEST 2002

2002: First Evaluation with 100,000+ samples

2002

GAIT

2010



2003

FRGC

2004: Statistical Modeling

2010: 1 Million + face image evaluation

MBE 2010

2010

2006

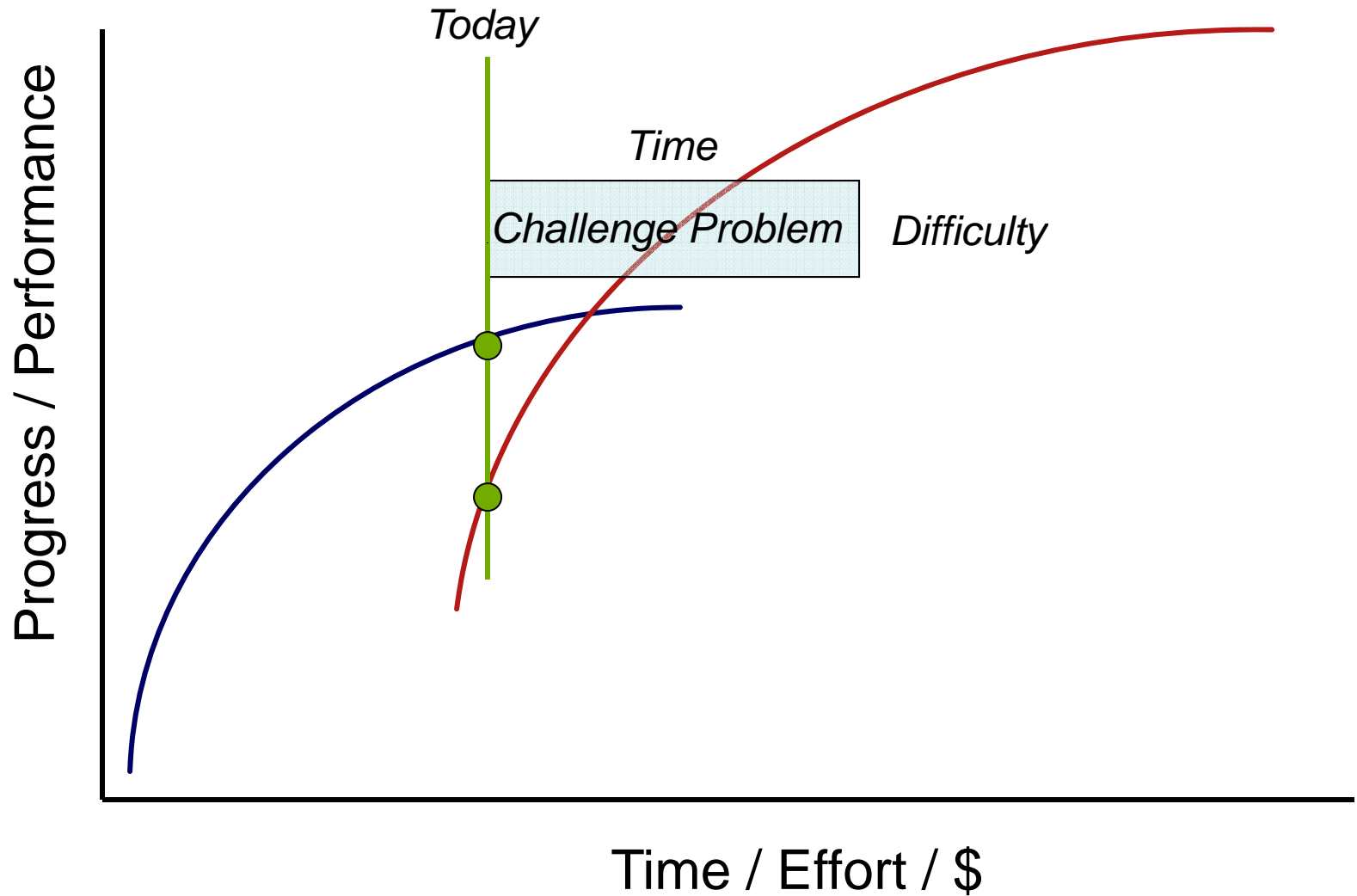
FACE RECOGNITION VENDOR TEST 2006

2008: Covariate Analysis of Quality

2007: Iris Meta-analysis

2004: Human & Computer Performance

Ideal Challenge Problem

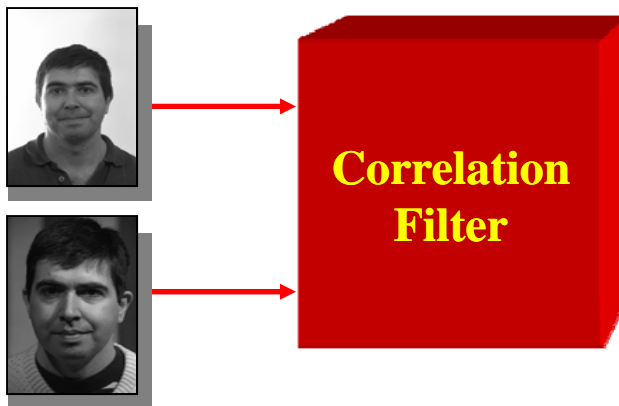


Challenge Problems and Technology Development

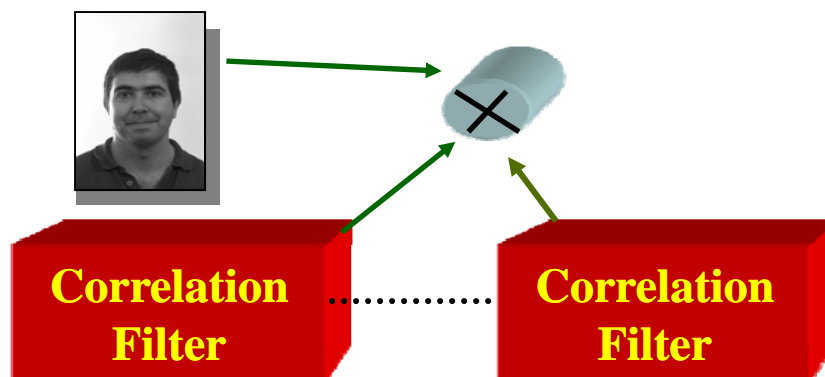
Example: Advanced Correlation Filter Method *

January 2005
MACE

Training - One Filter/Person

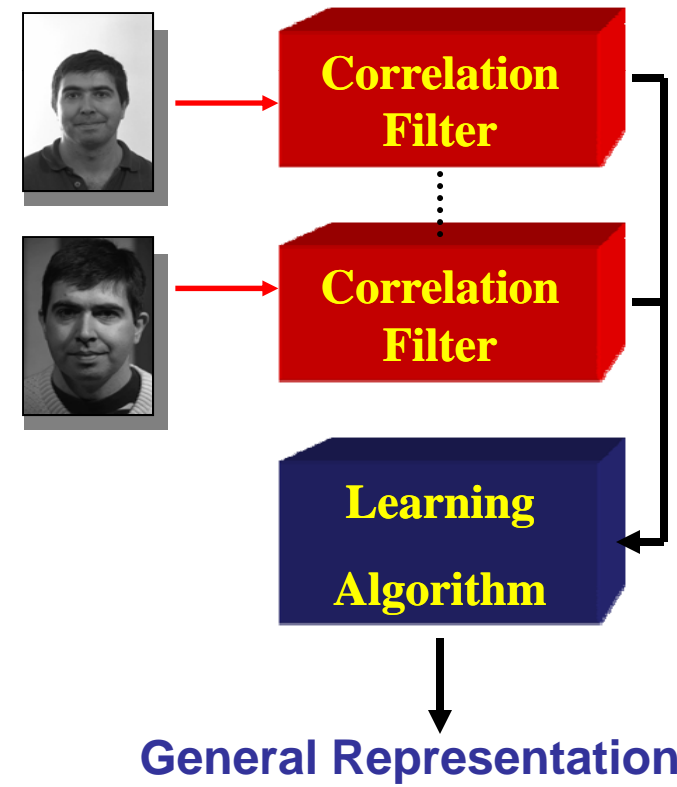


Recognition - Compare all Filters



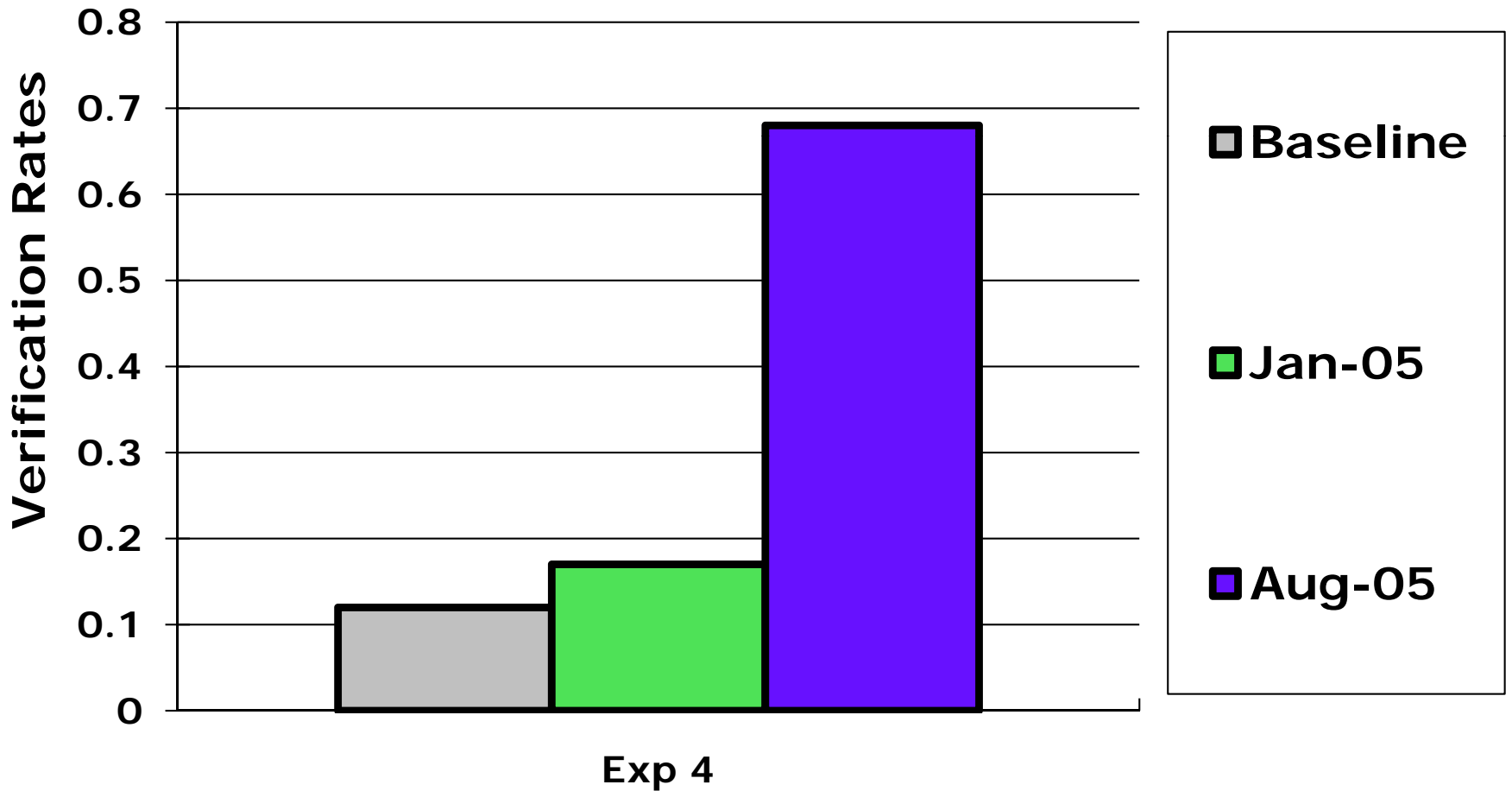
August 2005
Kernel Correlation Filter

Offline Training



* Xie, Savvides, Kumar 2005

Evolution of Improvement



The logo for the National Institute of Standards and Technology (NIST) is located on the left side of the slide. It consists of a vertical yellow bar on the far left, followed by a blue bar with a white grid pattern. The letters "NIST" are written vertically in white on the blue bar.

Building a Challenge

- Goals—Simple and grandiose
- Setting goals—Cheat
- Complete infrastructure for challenge problems
- Open to all

Conclusion on Basic Design

- Challenge problems
 - A very powerful tool
 - **NOT** the only tool
- A well designed challenge problem
 - Advances technology
 - Good Investment
 - 10+ year life span
- Poorly designed challenge problem
 - Waste resources
 - 10+ year life span

Summary

- Frontal Face Recognition
- Three orders of magnitude improvement
- Challenge Problems & Evaluations key components
- Development of new techniques
- Interdisciplinary Field
- Significant amount of research left
 - Face recognition from video
 - Low quality still images
 - Non-frontal stills recognition

