

Some Practical Applications of Pattern Recognition Research

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Pattern Recognition Research (PRR) Lab

Background

Pattern recognition research (PRR) attempts to instill in computers some of the cognitive capabilities of humans.

Particular examples of interest:

- character recognition (including handwriting)
- speech recognition & synthesis
- sequence analysis (bioinformatics)

Focus on applications & play both sides of the street:

- try to improve improve performance of computers
- study (and perhaps exploit) weaknesses of computers



Protecting Mobile Data

Data is becoming more portable (PDA's, cell phones, laptops, etc.) and theft is a growing concern.

Why aren't passwords enough?

- very easy to “crack”
- thief can just disassemble and reverse-engineer device

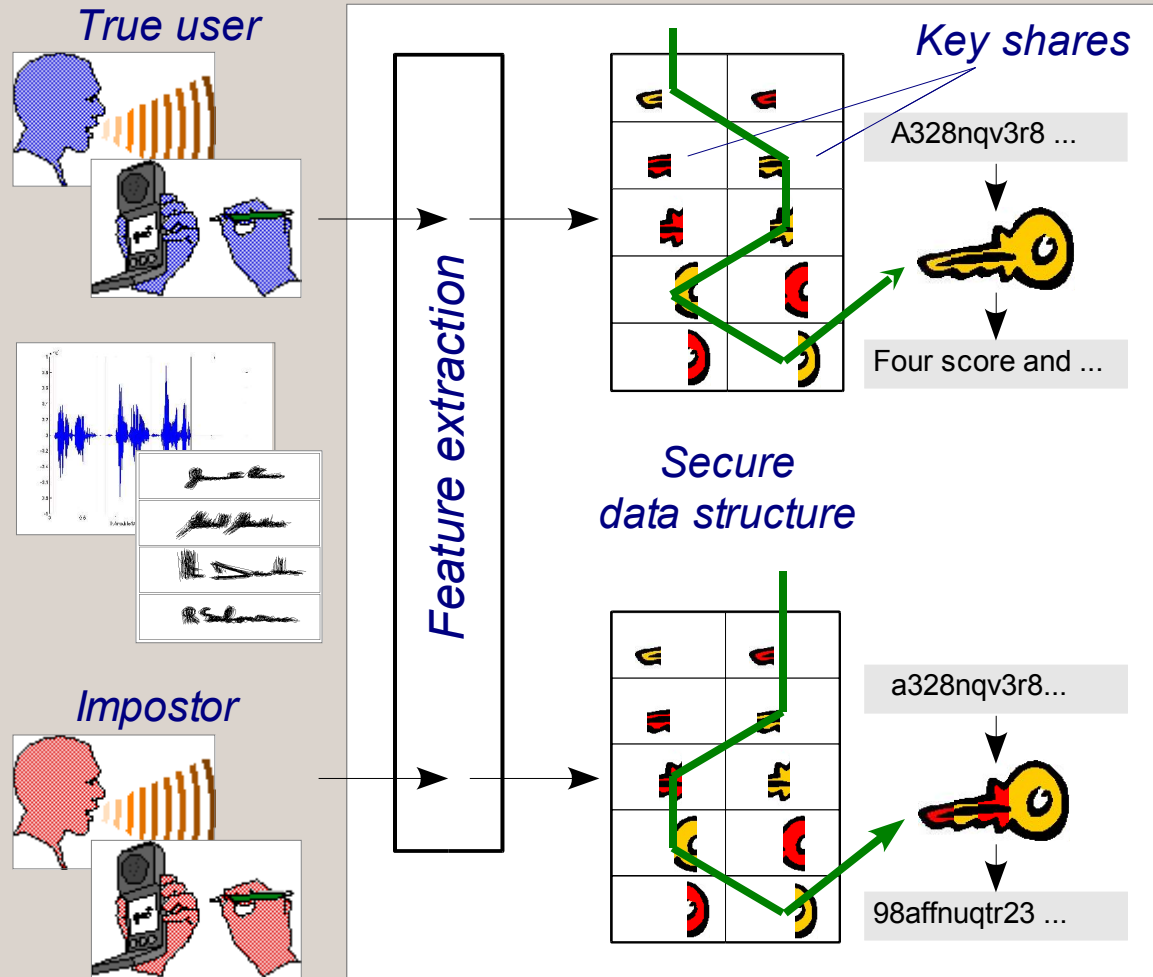
Two-pronged solution:

- use biometrics in place of (or in addition to) password
- use secure data structure to encrypt information



Protecting Mobile Data

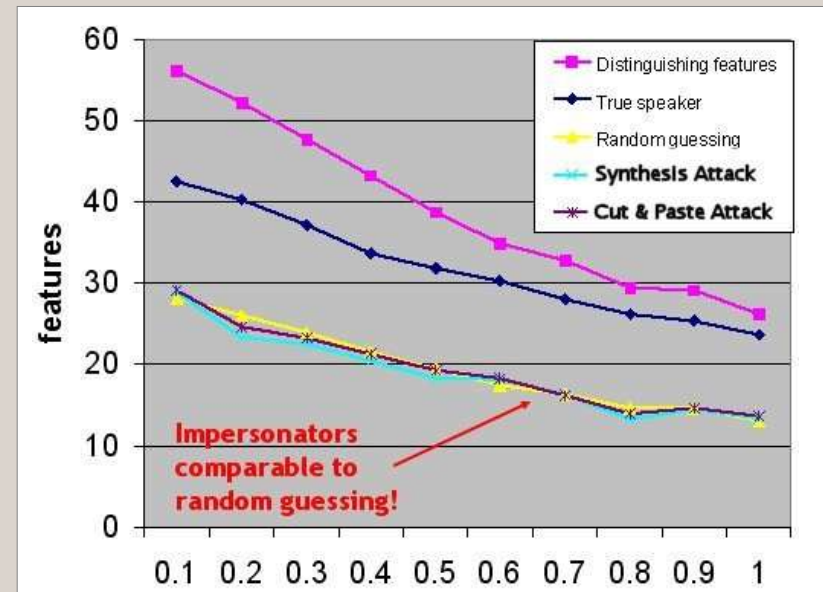
- key broken into shares and mixed with random data
- features extracted from user's speech or handwriting
- only input from true user will select correct shares to yield proper key



Protecting Mobile Data

Results of initial testing done at Bell Labs for spoken pass-phrases and two attack models:

- cut & paste
- synthesis



Much work remains to be done:

- only yields 35 bits for key (128 needed for good security)
- better attacks seem possible (will scheme hold up?)

“Towards Speech-Generated Cryptographic Keys on Resource-Constrained Devices.” F. Monrose, M. Reiter, Q. Li, D. Lopresti, and C. Shih, *Proceedings of the Eleventh USENIX Security Symposium*, August 2002, San Francisco, CA, pp. 283-296.



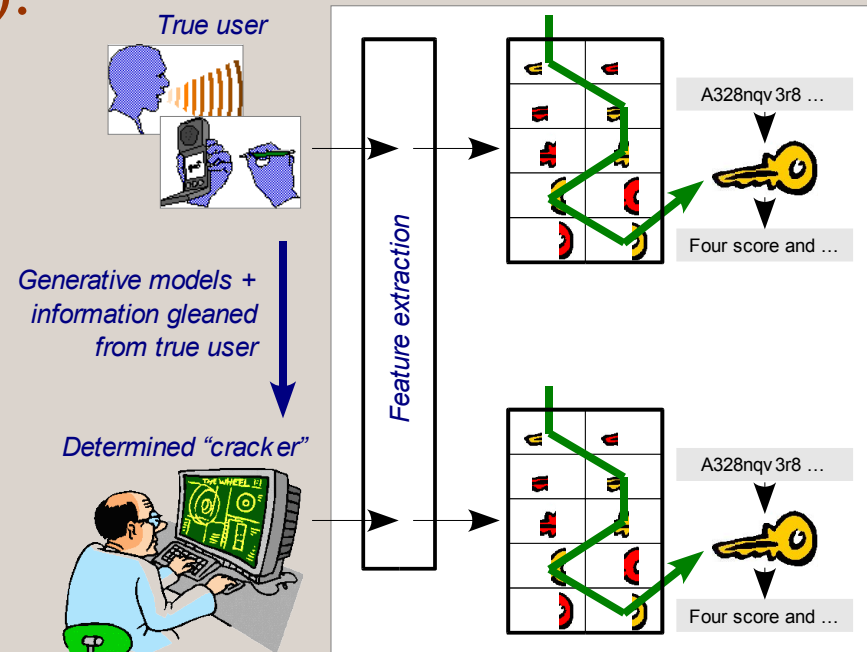
Protecting Mobile Data

Current plans (with Jarret Raim):

- quantify effectiveness
- increase number of bits
- identify potential attacks

Biometrics may be vulnerable:

- study generative models
- if successful, many current systems called into doubt



Use our experience to improve biometrics, increase security.

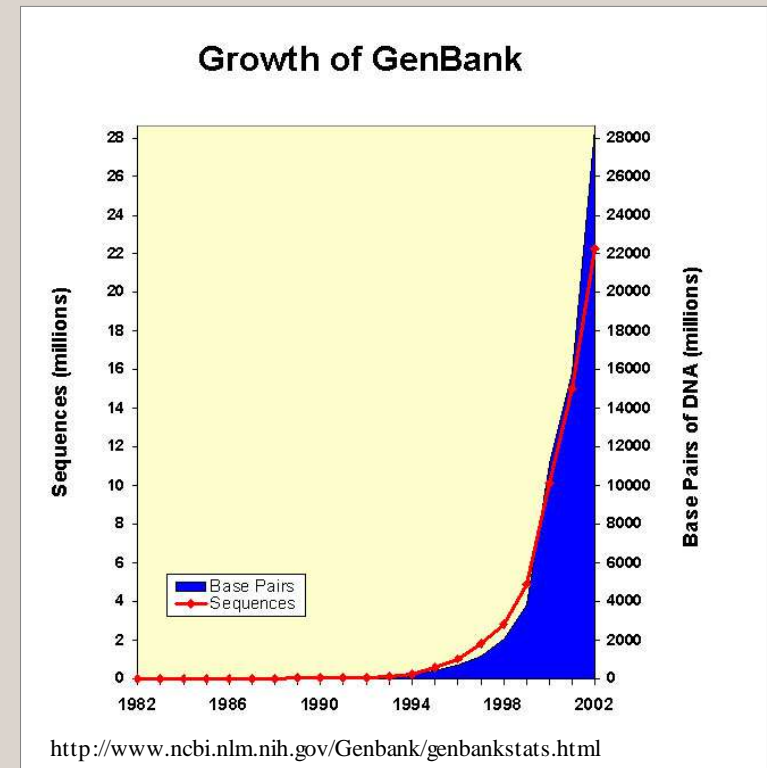
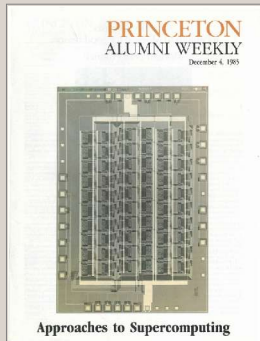
Plug: for more details, see our poster in Seigel Gallery during poster session at 4:00 pm.

Comparative Sequence Analysis

Given a new sequence, biologists want to:

- find other similar sequences
- understand relationships (functional, evolutionary)

Genomes are enormous ... hence comparative sequence analysis presents many challenges.



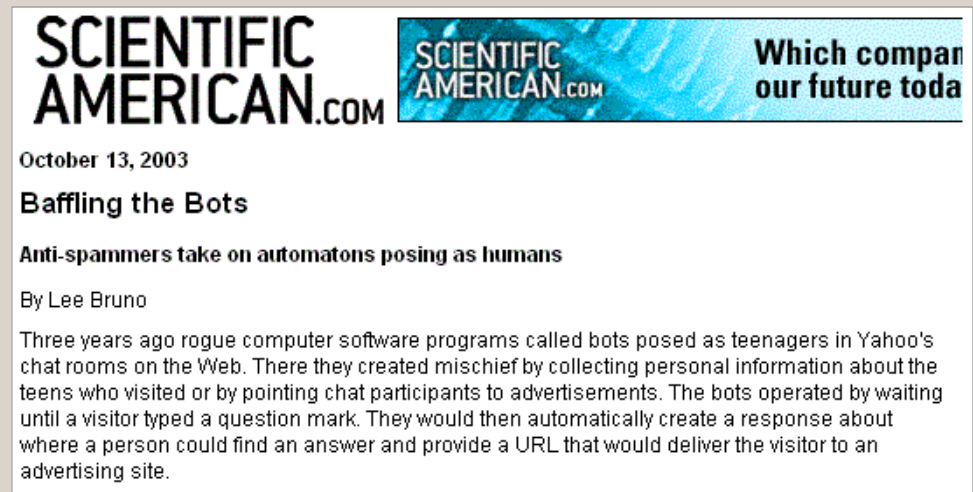
Plug: I will be teaching CSE special topics course on bioinformatics next semester.



Protecting Online Services

Internet has become vehicle for distributing valuable content. Malicious programs (“bots”) attempt to exploit online services intended for human users.

Idea: create a pattern recognition task easy for humans to solve but hard for machines.



SCIENTIFIC AMERICAN.COM **SCIENTIFIC AMERICAN.COM** Which compares our future today

October 13, 2003
Baffling the Bots
Anti-spammers take on automatons posing as humans
By Lee Bruno

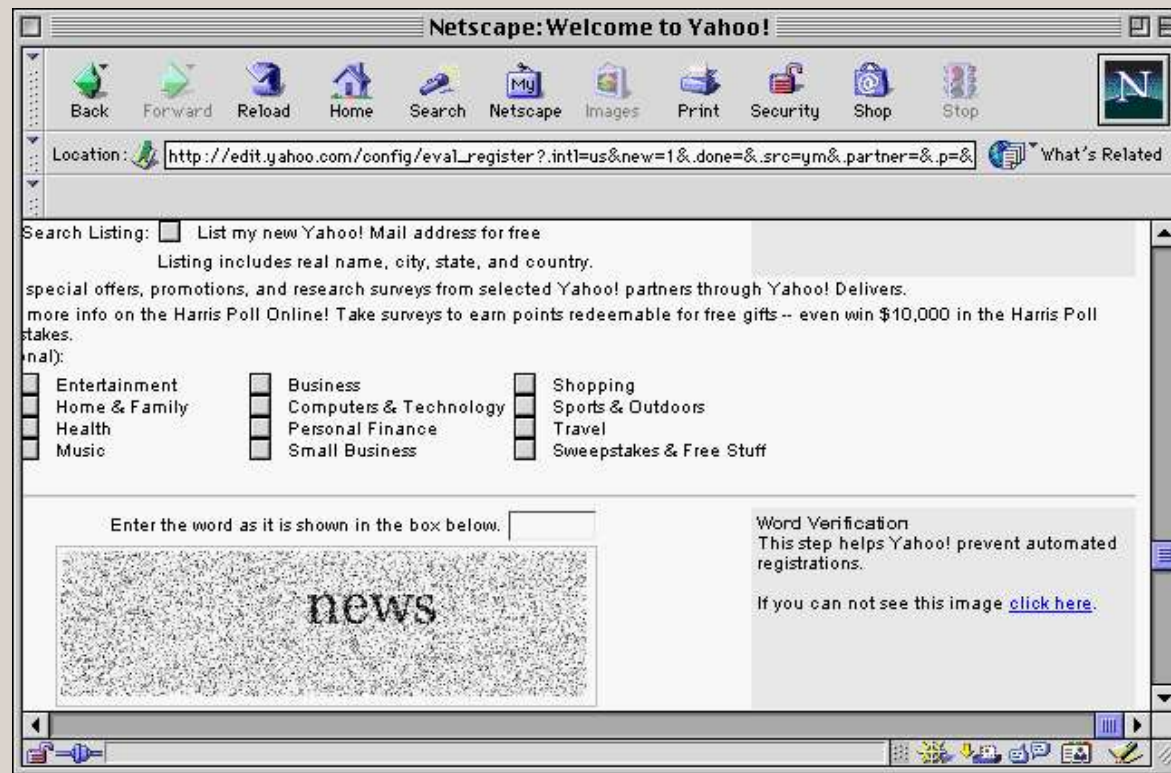
Three years ago rogue computer software programs called bots posed as teenagers in Yahoo's chat rooms on the Web. There they created mischief by collecting personal information about the teens who visited or by pointing chat participants to advertisements. The bots operated by waiting until a visitor typed a question mark. They would then automatically create a response about where a person could find an answer and provide a URL that would deliver the visitor to an advertising site.

Plug: Henry Baird of PARC will give seminar on this tomorrow at 4:00 pm in PL 416.



Protecting Online Services

Yahoo's method for protecting free email service. User must solve simple character recognition task:

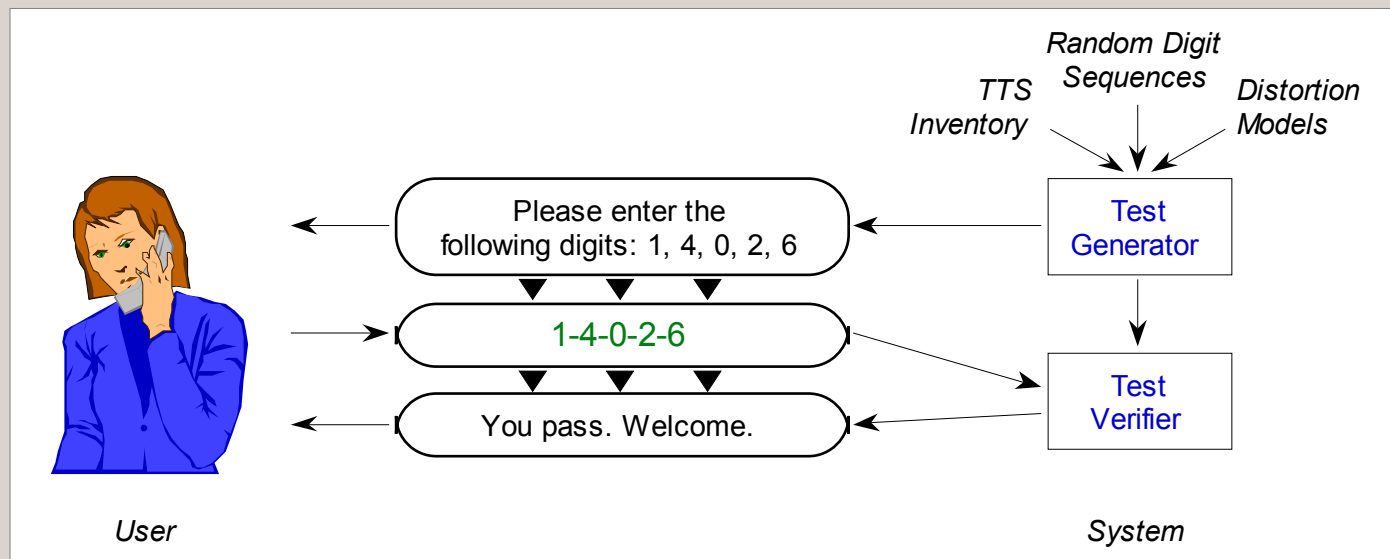


Protecting Online Services

Speech interfaces also growing in importance:

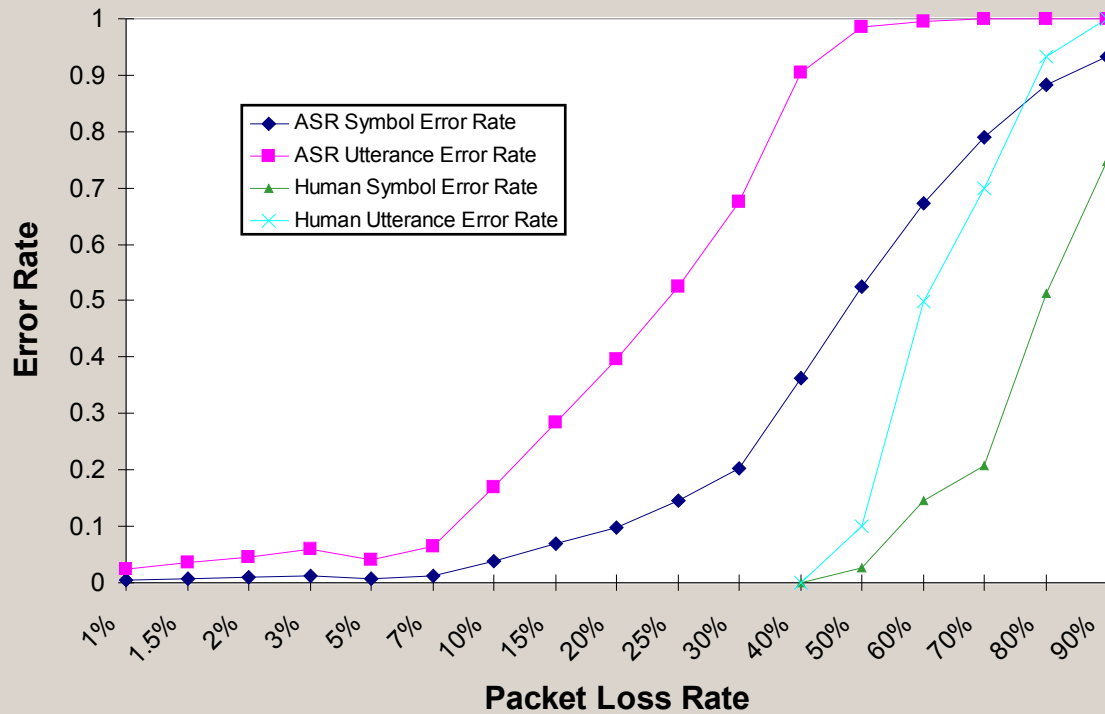
- phone access to financial services, reservations, etc.
- hands- and/or eyes-free applications (e.g., driving car)

Hence, similar security issues in spoken language domain.



Protecting Online Services

Bell Labs test comparing human vs. machine performance:



- cell phone simulation (many other cases also studied)
- humans nearly always much better than machine
- still open questions on how to use this

"A Reverse Turing Test Using Speech," G. Kochanski, D. Lopresti, and C. Shih, *Proceedings of the Seventh International Conference on Spoken Language Processing*, September 2002, Denver, CO, pp. 1357-1360.

Summary

Applications for pattern recognition research abound.

In PRR lab at Lehigh, our goals are to:

- identify interesting, important real-world problems
- apply best known techniques and develop new ones
- contribute to PR community and also related fields
- be cognizant of social and ethical issues arising from work

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