# CalREN 2

High Performance Network Applications at UCSF


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# Research Projects

- Modeling Visual Cortical Function

  Michael Stryker, UCSF

  Steven Zucker, Yale University

- High Performance Tele-Imaging for Collaborative Health Care

  H.K. Huang, UCSF

- Molecular Modeling Collaboratory

  Thomas Ferrin, UCSF

  Jane and David Richardson, Duke University

# Modeling Visual Cortical Function

Question:

How does the human visual system detect the edges of objects?

Hypothesis:

Requires a non-linear operator with multiple functions based on "curvature continuation"

Experiment:

Iteratively measure physiological brain response to changing visual stimuli

# Experimental Setup

- Present stereoscopic video image to test animal (cat)
- Supercooled CCD camera images 2mm x 3mm section of cerebral cortex
  - Change in absorption of red light indicates change in deoxygenated hemoglobin concentration as a result of visual stimulus
  - 1.5MB of data collected in 1.5 seconds
- Transmit data to Yale Computer Science Dept. for construction of curvature continuation maps
- Modify visual stimulus as a result of map analysis and generate new video display
  - 6.1MB of (uncompressed) video data returned to UCSF
- Repeat process every 12 seconds

[Ocular Dominance Columns image goes here]

[Orientation Dominance Maps image goes here]

[Left Eye/Right Eye Visual Cortex diagram goes here]

# For More Information See...

"Ocular Dominance Peaks at Pinwheel Center Singularities of the Orientation Map in Cat Visual Cortex," Michael C. Crair *et.al,* J. Neurophysiology, June 1997.

Grant proposal to the National Institutes of Health currently being reviewed.

# Tele-Imaging for Collaborative Health Care

Provide necessary infrastructure for supporting radiological tele-consultations:

- Images captured at one location interactively analyzed and archived at another location
- Typical image: 10MB
- Current UCSF PACS system archives 2.5 - 3GB of images/day
- 50% of these transit the network

Supported by a HPCC grant from the National Library of Medicine (N01-LM-4-3508).

[Digital X-ray Image Processor photo goes here]

[Digital Chest Radiograph image goes here]

[Photo of Dr. Gooding working at ISG station goes here]

[Initial ATM Network diagram goes here]

[CalREN ATM Network diagram goes here]

[Measured Data Throughput table goes here]

# Impact on the Health Care Industry

- Sucessfully demonstrates that an OC-3 wide area ATM network is applicable to the health care industry (network has been in use since 10/94)
- Demonstrates that medical images can be delivered between sites almost in real-time
- Opens the door for real-time tele-management applications and direct improvement to patient care

# Molecular Modeling Collaboratory

Goal:

- To collaborate at a distance with other scientists on interactive computer aided molecular design (CAMD) projects

Vision:

- Support desktop video teleconferencing - e.g. SGI's "InPerson"
- Utilize standard audio I/O features found on most workstations
- Provide separate instances of the CAMD application running on each collaborator's workstation supporting private and "synchronized" views

Supported by a National Institutes of Health grant (P41-RR01081).

[Image of Thyroxine analog and PAB protein goes here]

[Thyroxine + PAB after first modification goes here]

[Thyroxine + PAB after second modification goes here]

[Photo of workstation, interactive devices, and stereo glasses goes here]

# Implementation Overview

- Enhance UCSF “Chimera” Computer Aided Molecular Design (CAMD) system to support graphics state synchronization and remote data sharing
- Transmit compressed video (a few frames/second should be fine) and real-time audio (low latency and good quality critical)
    - Depend on RSVP to reserve needed bandwidth and to synchronize video and audio
- Two-phase implementation approach:
    - Phase 1: two collaborators
    - Phase 2: N collaborators with facility for joining sessions already in progress

# Collaboratory Uses

- Traditional scientific collaboration
- Feedback to Chimera developers on problems and new ideas
- Interactive tutorial-style training for new users (distance learning)

# Conclusions

- There is a clear and present need for a high-bandwidth low-latency Internet in support of a variety of funded research projects
- The network infrastructure provided by the CENIC initiative should be application driven to insure that the functionality needed is what is provided
- Additional applications will appear as soon as the needed network infrastructure is available to researchers