

Introduction to AI

- What is AI?
- History of AI
- Famous applications

The motivation for AI

- Create artificial beings that can solve problems for the human “master”
- Simple problems can be solved easily by machines (see calculator)
- Complex problems can be not
 - The human is not capable to specify HOW the machine has to solve the problem
 - The machine therefore must find a solution on its own



http://www.learnsite.ch/deutsch/literatur/zauberlehrling/zauberlehrling_04.jpg

- This requires human-like intelligence

AI definitions

- AI
 - Is the science and engineering of making intelligent machines (John McCarthy, 1956)
- Weak AI
 - In the early 1970s the weak AI split from general AI to focus on “productive or applied” AI
 - Machine Learning was born
- Strong AI
 - Machines are actually intelligent including
 - Consciousness and self-awareness
 - Reach or exceed human intelligence
 - For the later, the term “singularity” is used

Machine Learning

Wikipedia Learning and Machine Learning

- Learning (general)
 - Learning is acquiring new knowledge, behaviors, skills, values or preferences
 - It may be goal-oriented and may be aided by motivation
- Machine Learning (specific)
 - any computer program that improves its performance P at some task T through experience E (Mitchell 1997)
 - Performance can be measured
 - Task can be described
 - Experience is represented by data (e.g. from sensors)

Artificial Machines versus Life

- Construction versus reproduction
- Life
 - DNA encode basic live preserving functions
 - Must face the environment they are born to



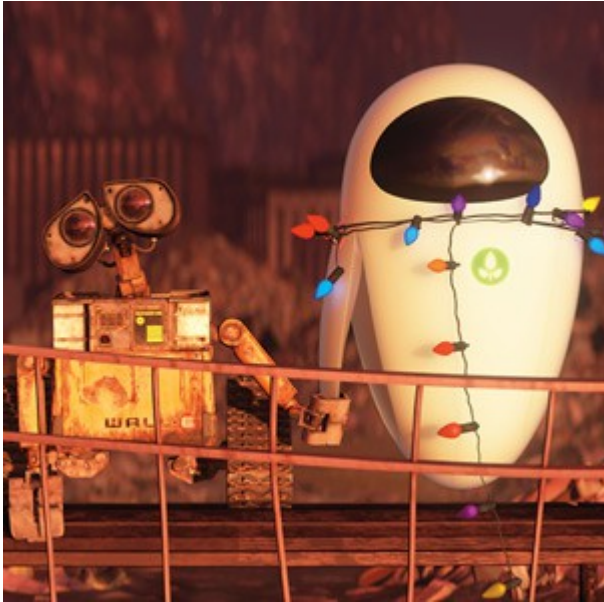
Advantages of Learning

- Dynamic adaption to changing environment
- Self adapting to complex worlds
- Find solutions which are not bounded by the capacity of their creators



http://www.einslive.de/magazin/service/2008/img/reise_abc_kakerlake_dpa_g.jpg

Robots and Machines you probably know



<http://rippleeffects.files.wordpress.com>



Flickr Image von User Don Solo



<http://www.geekmag.fr/blog/wp-content/uploads/2008/05/johnny5-short-circuit.jpg>



<http://www.dedroidify.com/blogimages/star-trek-data-androide.jpg>



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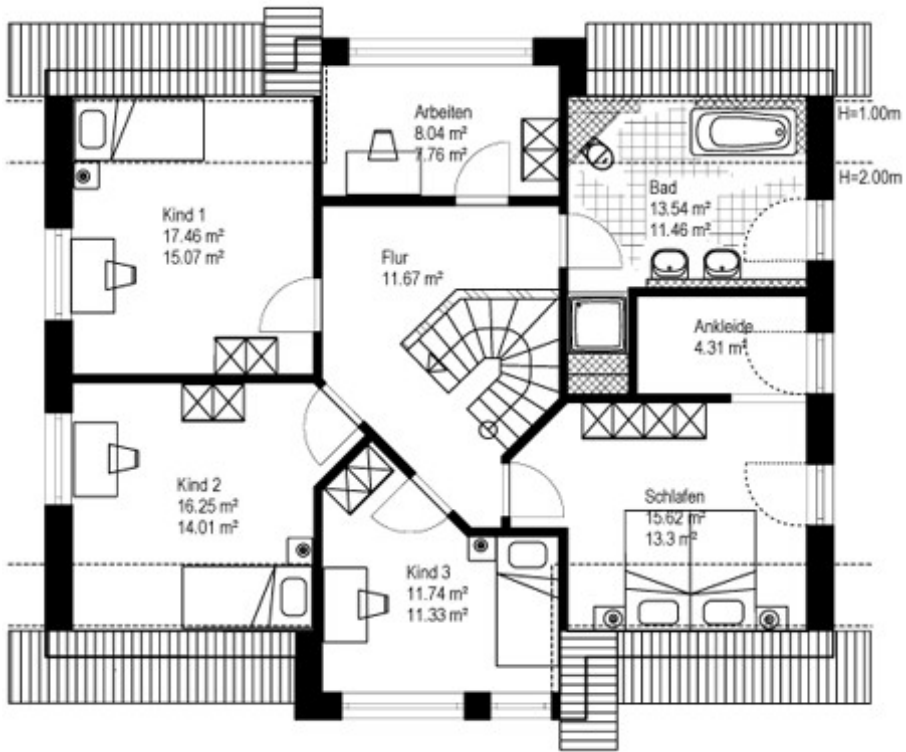
Artificial Machines versus Life

- Machine
 - Everything constructed from scratch
 - Never intended to leave their working place



<http://blog.daimler.de/wp-content/uploads/2008/07/roboerarm.jpg>

The role of the computer scientist



zielsdorf-massivhaus.de



<http://www.koch-erkner.de/hausbau>

Popular Applications

- ML is the most wanted skill employers want from graduates
 1. Machine Learning
 2. Mobil applications
 3. Wireless networking
 4. Human-computer interfaces
 5. Project management
 6. Networking skills
 7. Network techs
 8. Open-source progr.
 9. Business-Intelligence Systems
 10. Embedded security
 11. Digital home tech
 12. Programming
- ML is used across all disciplines

A Short History of AI/ML

Pre 1950s-1960s

- Thinking machines and artificial beings appear in Greek mythology (Talos, Crete)
 - AI beings are crowding science fiction movies
- The field of AI research was founded in 1956, heavily funded by Department of Defense
- The first artificial neuron was invented by Rosenblatt (1957)
 - After Minsky & Papert disproved Rosenblatt, the research was discouraged
- Fuzzy Sets are proposed by Lotfi Zadeh

1960s

- AI pioneer Herbert Simon wrote 1965
 - “machines will be capable, within twenty years, of doing any work a man can do”
 - Inspire Stanley Kubrick and Arthur C. Clarke (HAL 9000)
- In the early 1970s it became obvious that researchers underestimated the effort

1970s

- Advances of symbolic knowledge representation
- Diagnostic systems / Expert systems
 - e.g. Mycin
 - Rule based system
 - outperformed members of the Stanford medical school faculty
 - Raised ethical questions
- U.S. And Britain cut off exploratory reasearch as it was not productive (the AI winter began)

1980s

- Quinlan's ID3 (decision tree algorithm)
- PAC-Learning (probably approximately correct) by Valiant 1984
- Rumelhart activated connectionistic research in 1986 (backpropagation, and layered nets)
- Invention of case based learning / learning from samples
- In 1987 another AI winter began until computers have gained more processor capacity

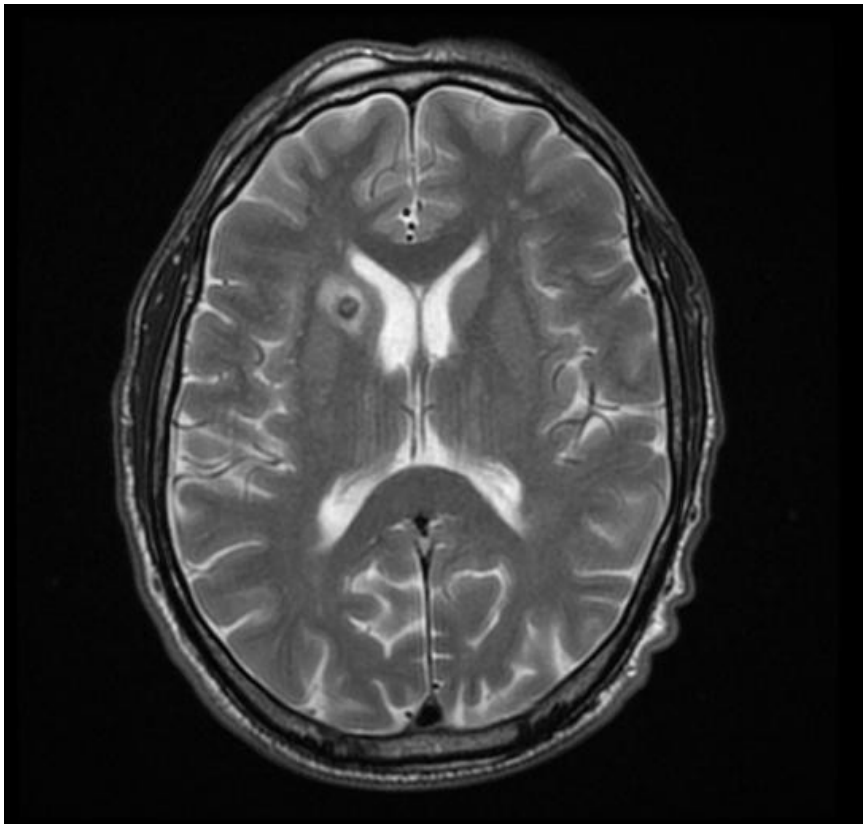
1990s

- Bayesian Learning (Classification and Inference)
- Reinforcement Learning
- Data Mining has emerged as application
- Robotics uses ML
- Evaluation of learning algorithms plays a big role
 - Standard datasets for comparison
- Until today: tons of applications and domains

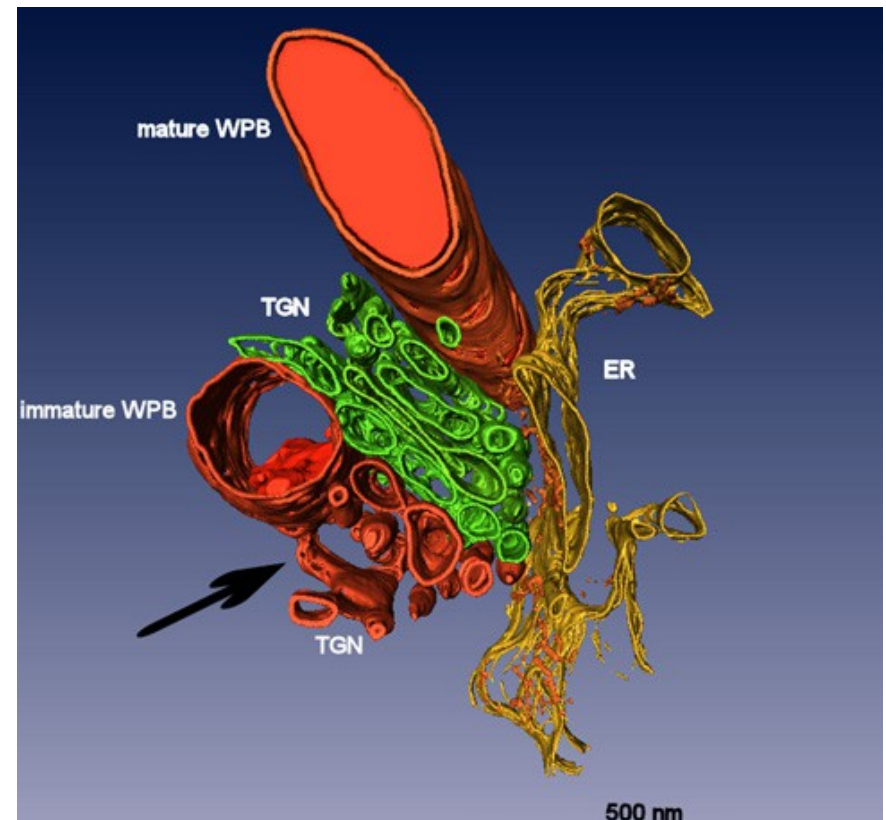
Applications beyond Robotics

Medicine

- Given the symptoms predict the disease
- Automatic count of pathogenic cells in a probe



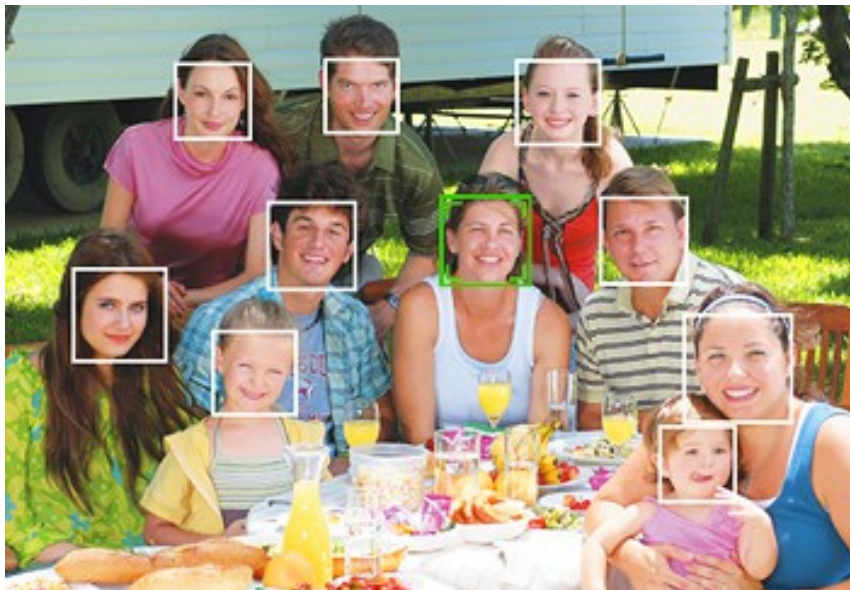
Magneto-Resonance-Imaging, wikipedia



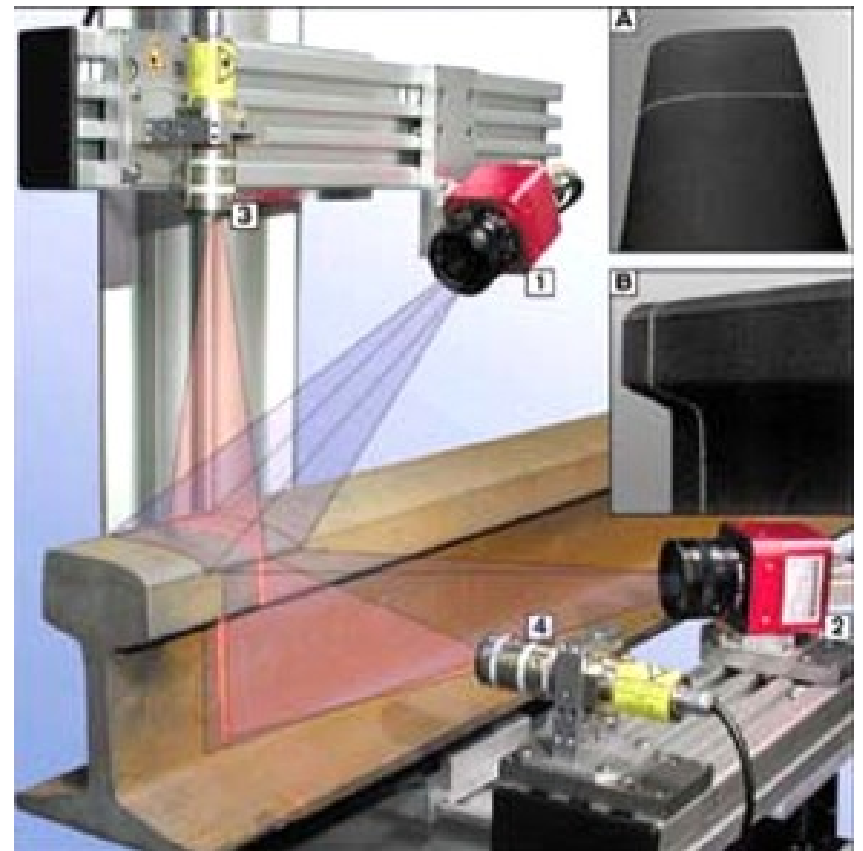
<http://www.meduniwien.ac.at/3dmorphology/3d-compo>

Face and object detection

- Find people in images
- Check produced parts as part of quality service



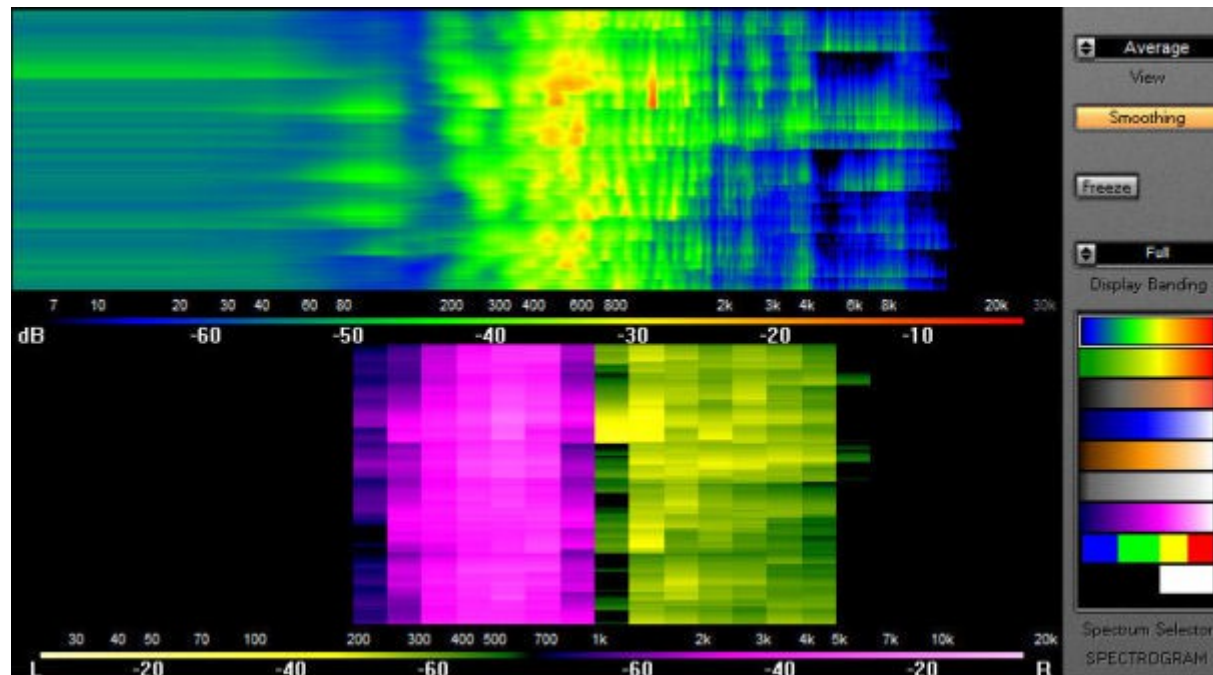
Fuji, Face Detection PR Material



Rauscher, Qualitätskontrolle Eisenbahnschienen

Audio detection

- Speaker detection



<http://www.nugenaudio.com/images/spectrogram.jpg>

Hand Writing Recognition

- Postal Service
- OCR- written letters to symbolic text (document management)
 - Stasi-Schnipsel-Jagd



Advertising

- Google Adwords
- Recommendation engines (à la Amazon)
- Matching Plattformen



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Banking and Money

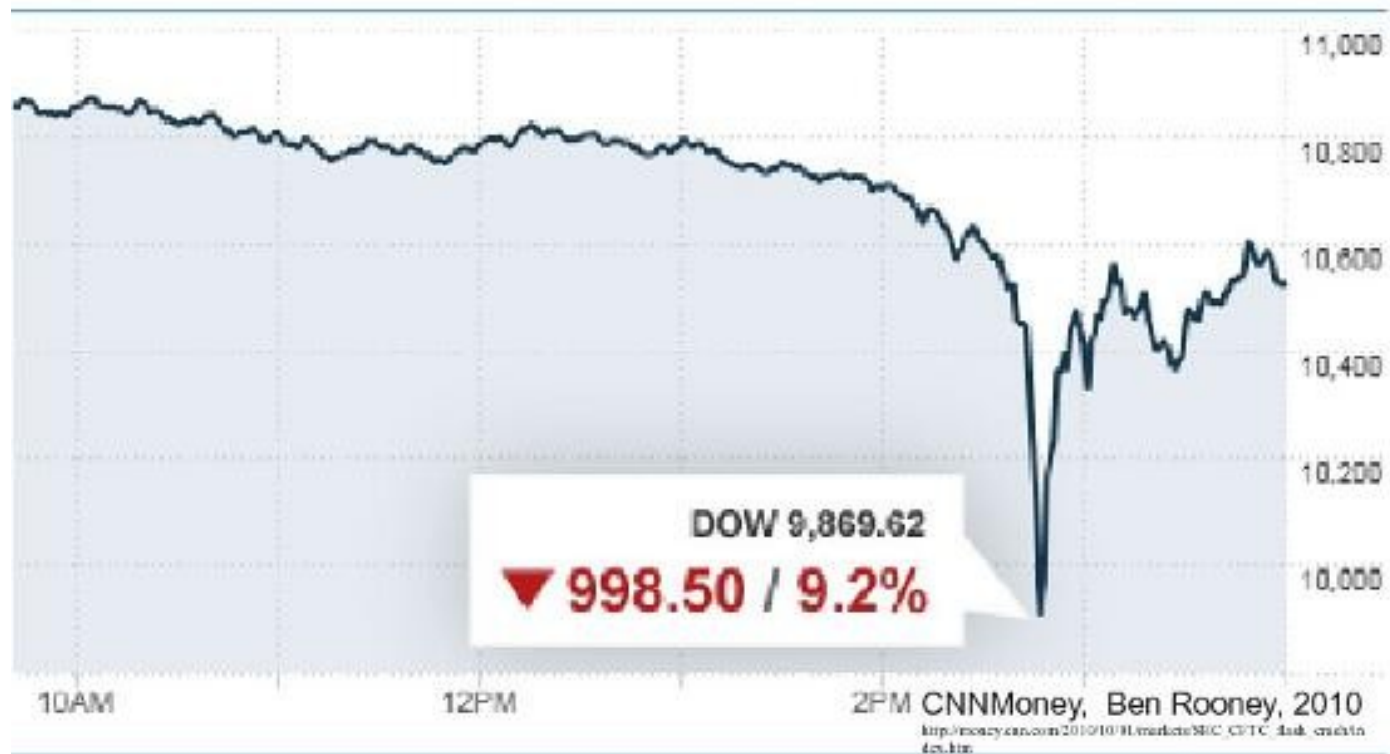
- Fraud detection
- Trend detection
- Outlier detection
- Prediction***



<http://www.buyability.co.uk/wp-content/uploads/MoneyClock-Banking-CloseUp.gif>

The Flash

The Flash



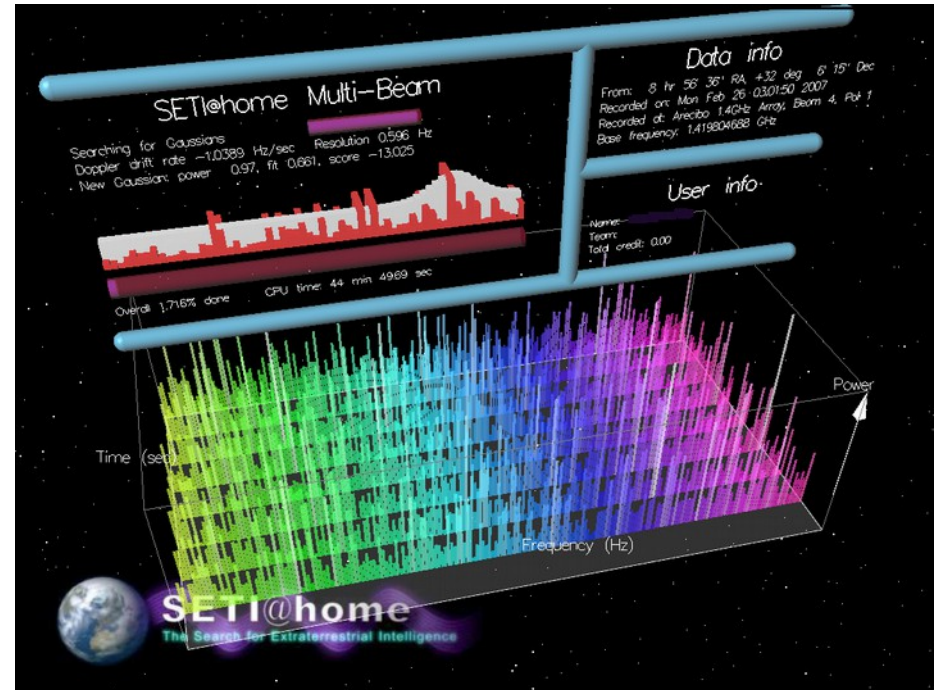
elaspix

Search for Aliens

- SETI
- Classification of galaxies and deep space objects



Wikipedia, Very Large Array



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