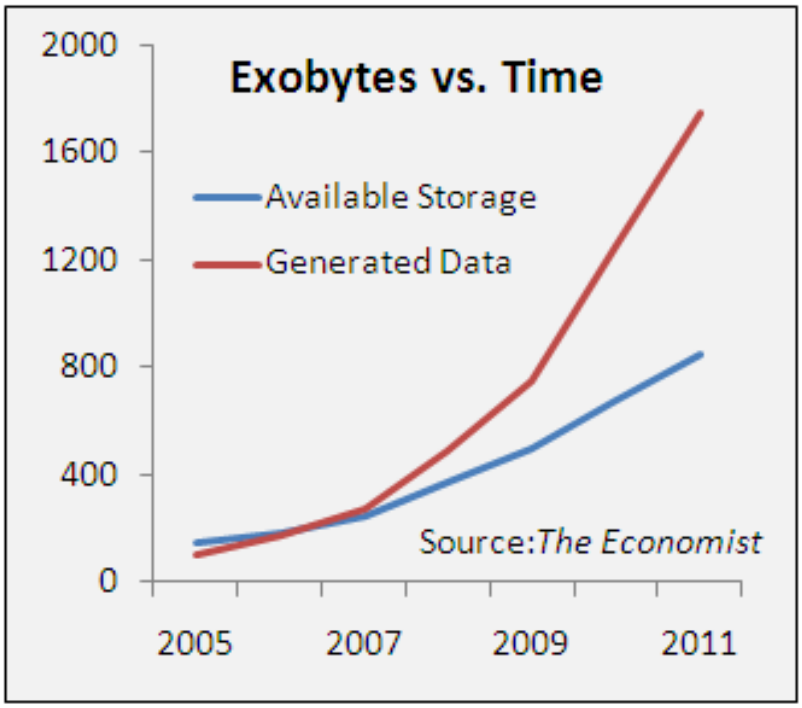
Brainlike Technology Reduces Data Overload

Data overload is a huge problem. Billions of sensors already generate data at staggering rates, and data creation is growing at an annual rate of 60%, according to a special report in *The Economist* (27 Feb. 2010). The same report states that generated data surpassed available storage over three years ago.

Besides overloading storage, data generation overloads transmission networks. Communication bottlenecks have increasingly frustrated millions of personal computer and cell phone users, as video and audio data generated by them has exploded. What's worse, channels are swamped by data from billions of other sensors, monitoring everything from domestic and industrial process status to equipment, environment, and human health.



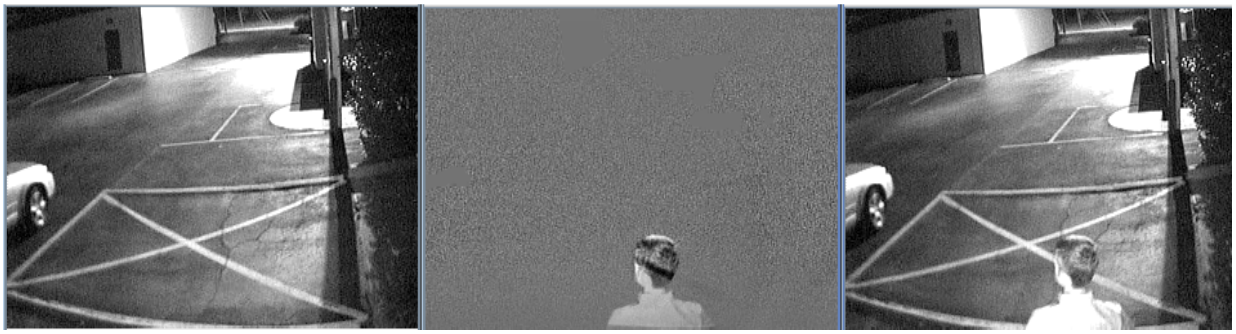
As the overload continues to grow, effective methods for processing and reducing data are becoming increasingly valuable. Anticipating related needs, Brainlike Inc., has developed powerful data reduction technology. Brainlike provides patented computing solutions for reducing cluttered sensor data to valuable information in real time. "Brainlike sensing" — developed for U.S. military surveillance and refined for commercial monitoring — finds nuggets of useful information in streams of real time data, and ignores the rest. Brainlike sensing is a very general technology that has effectively reduced sonar, radar, tomography, magnetometer, and accelerometer data.

While preparing to meet general overload needs, Brainlike has targeted video camera data reduction as the strongest opportunity. Brainlike has recently developed PixMin™, a computing system that mines, minimizes, and "minds" video data at the pixel level. PixMin™ automatically identifies interesting pixels in video data and ignores the rest, in real time. Once it has done so, PixMin™ transmits and stores packets, containing only informative pixels. PixMin™ organizes packets so that interesting events can be easily recovered and highlighted within video streams

that appear to be otherwise intact. A typical PixMin™ data reduction configuration reduces transmission and storage by over 95%, while highlighting important events.

PixMin™ identifies interesting events in a variety of adaptive ways, including but not limited to motion detection, template matching, feature based event detection, simple change detection, and change detection that corrects for camera motion. Visual data may come from conventional cameras in gray scale or red, green, and blue (RGB) form, as well as from infrared, radar, tomography, and other sources. Cameras, radars, or other sensors may be either stationary or moving. While competitive compression methods such as H.264 can reduce visual data by about 85%, PixMin™ can reduce it by more than 95%. Along with this threefold improvement in data reduction over compression methods, PixMin™ uniquely reproduces events of interest in full resolution. Full reproduction improves image clarity over compression methods, which look fuzzy when zoomed in. Briefly stated, patent pending PixMin™ offers a new standard for massive data reduction, along with analytic clarity at the pixel level.

PixMin™ operates as client and server applications, which may reside on computers, cell phones, and custom sensing systems. PixMin™ servers create packets of reduced output frames and send them to PixMin™ clients for storage, recovery, and display. Each PixMin™ packet contains a reference frame and reduced frames. PixMin™ transmits all reference frame pixels, while transmitting only interesting pixels from reduced frames. For reproduction and display, PixMin™ superimposes reduced frame pixels on their corresponding reference frame pixels.



The above figure shows how PixMin™ data reduction works. The frame on the above left shows a reference frame that PixMin™ transmitted and saved in full resolution. The frame in the middle shows interesting pixels that the PixMin™ server identified. The frame on the right shows the resulting, fully recovered PixMin™ display.

Besides reducing video camera data with full resolution recovery, PixMin™ increases operator effectiveness by highlighting interesting events. Anyone who has seen a security camera display knows that noticing events is not easy. Typically, an operator must view more than one screen,

the screens hardly ever show anything interesting, the operator is otherwise occupied, and interesting events often go unnoticed. PixMin™ highlighting makes interesting events stand out.

To illustrate PixMin™ highlighting, the next figure shows a reference frame for a packet on the left and the last frame for the packet is on the right. An open vehicle is shown, moving from its left frame position to its right frame position, within an otherwise stationary background.

The next figure shows a PixMin™ client display of the final frame, when operating in highlight mode. PixMin™ marks objects at their current location and tracks their motion back to recent locations. Besides highlighting events in this way, the PixMin™ client triggers audible and visual alerts.

PixMin™ also makes historical data analysis easier. Often, an event that has been stored on tape must be found afterwards. Doing so can take hours of tedious playback. The problem becomes much easier, once video searches have been narrowed down to frames that PixMin™ has marked as interesting.

Beyond video data reduction, Brainlike sensing removes mountains of useless data, generated by billions of sensors. Brainlike technology reduces data overload — the biggest emerging problem of the information age.