eliminates any moving screen seen in previous approaches, so there is no image jitter, and has an inherent parallel mechanism for 3D voxel addressing.

High spatial resolution is possible with a full color display being easy to implement. The system is low-cost and low-maintenance.

⚇ MMIC Replacement for Gunn Diode Oscillators

Goddard Space Flight Center, Greenbelt, Maryland

An all-solid-state replacement for high-frequency Gunn diode oscillators (GDOs) has been proposed for use in NASA's millimeter- and submillimeter-wave sensing instruments. Highly developed microwave oscillators are used to achieve a low-noise and highly stable reference signal in the 10–40-GHz band. Compact amplifiers and high-power frequency multipliers extend the signal to the 100–500-GHz band with minimal added phase noise and output power sufficient for NASA missions.

This technology can achieve improved output power and frequency agility, while maintaining phase noise and stability comparable to other GDOs. Additional developments of the technology include: a frequency quadrupler to 145 GHz with 18 percent efficiency and 15 percent fixed tuned bandwidth; frequency doublers featuring 124, 240, and 480 GHz; an integrated 874-GHz subharmonic mixer with a mixer noise temperature of 3,000 K DSB (double sideband) and mixer conversion loss of 11.8 dB DSB; a high-efficiency frequency tripler design with peak output power of 23 mW and 14 mW, and efficiency of 16 and 13 percent, respectively; millimeter-wave integrated circuit (MMIC) power amplifiers to the 30–40 GHz band with high DC power efficiency; and an 874-GHz radiometer suitable for airborne observation with state-of-the-art sensitivity at room temperature and less than 5 W of total power consumption.

⚇ Feature Acquisition With Imbalanced Training Data

NASA's Jet Propulsion Laboratory, Pasadena, California

This work considers cost-sensitive feature acquisition that attempts to classify a candidate datapoint from incomplete information. In this task, an agent acquires features of the datapoint using one or more costly diagnostic tests, and eventually ascribes a classification label. A cost function describes both the penalties for feature acquisition, as well as misclassification errors.

A common solution is a Cost Sensitive Decision Tree (CSDT), a branching sequence of tests with features acquired at interior decision points and class assignment at the leaves. CSDT's can incorporate a wide range of diagnostic tests and can reflect arbitrary cost structures. They are particularly useful for online applications due to their low computational overhead.

In this innovation, CSDT's are applied to cost-sensitive feature acquisition where the goal is to recognize very rare or unique phenomena in real time. Example applications from this domain include four areas. In stream processing, one seeks unique events in a real time data stream that is too large to store. In fault protection, a system must adapt quickly to react to anticipated errors by triggering repair activities or follow-up diagnostics. With real-time sensor networks, one seeks to classify unique, new events as they occur. With observational sciences, a new generation of instrumentation seeks unique events through online analysis of large observational datasets.

This work presents a solution based on transfer learning principles that permits principled CSDT learning while exploiting any prior knowledge of the designer to correct both between-class and within-class imbalance. Training examples are adaptively reweighted based on a decomposition of the data attributes. The result is a new, nonparametric representation that matches the anticipated attribute distribution for the target events.