USC Student Innovator Showcase

Using the Viterbi Algorithm to Clean up Noisy Entanglement

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USC VITERBI SCHOOL OF ENGINEERING

Synopsis

In 2004, the USC School of Engineering became the Viterbi School of Engineering in honor of Andrew Viterbi. Viterbi is the father of the cell phone industry and developed his algorithm in 1967 as a scheme for identifying and correcting errors in noisy digital communication.

2007 marks the 40th anniversary of the Viterbi Algorithm.

We have discovered a novel way[1] to incorporate convolutional coding strategies and the Viterbi Algorithm to produce useful entangled bits from a set of noisy entangled bits. Devices of the future will communicate with entangled bits because they are the foundation for several quantum communication protocols. Our research will help two parties secure a message using our technique for quantum communication.

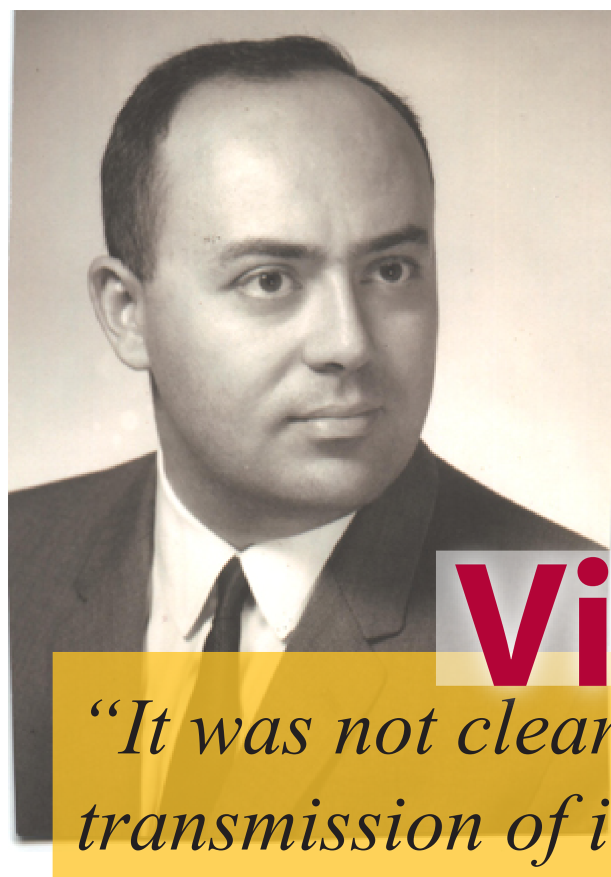
[1] M. M. Wilde, H. Krovi, T. A. Brun. *Convolutional Entanglement Distillation*. arXiv:0708.3699, August 2007.

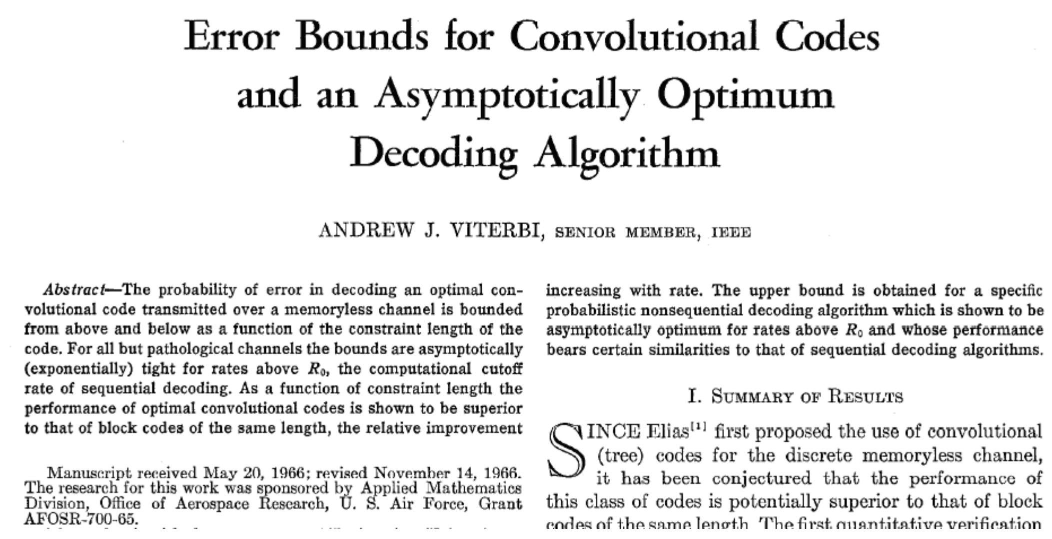
Potential Societal Impact

This method for cleaning up noisy entangled bits will have a profound impact on the way we communicate in the future.

Experiments by other researchers have already demonstrated long-distance entanglement. Two European Space Agency stations separated by 144 km on the Canary Islands established entanglement between photons, but the resulting entanglement from these experiments was noisy.

We can use our method to clean up a set of noisy entangled bits, and the resulting noiseless entangled bits will be useful for a quantum communication task such as two parties sharing a secure message. One could imagine our method being used in the quantum networks of the future.





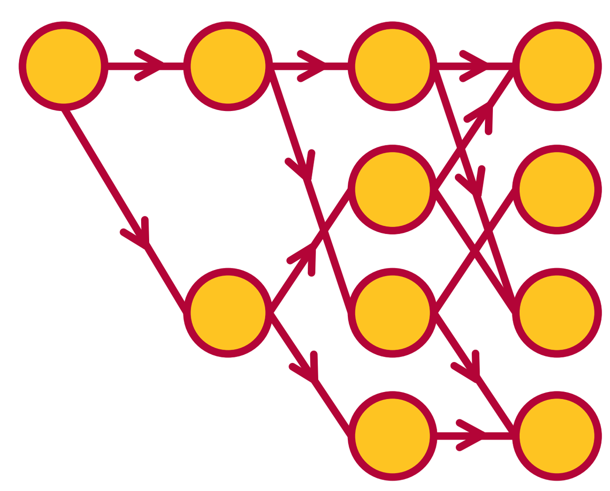
Error Bounds for Convolutional Codes and an Asymptotically Optimum Decoding Algorithm

ANDREW J. VITERBI, SENIOR MEMBER, IEEE

Viterbi Algorithm

"It was not clear that an algorithm for efficient transmission of information from large distances would have wide applicability in industry; it was simply a step in the proof of some theories. The possibilities opened up .... The Viterbi algorithm turned out to have legs."

From '67

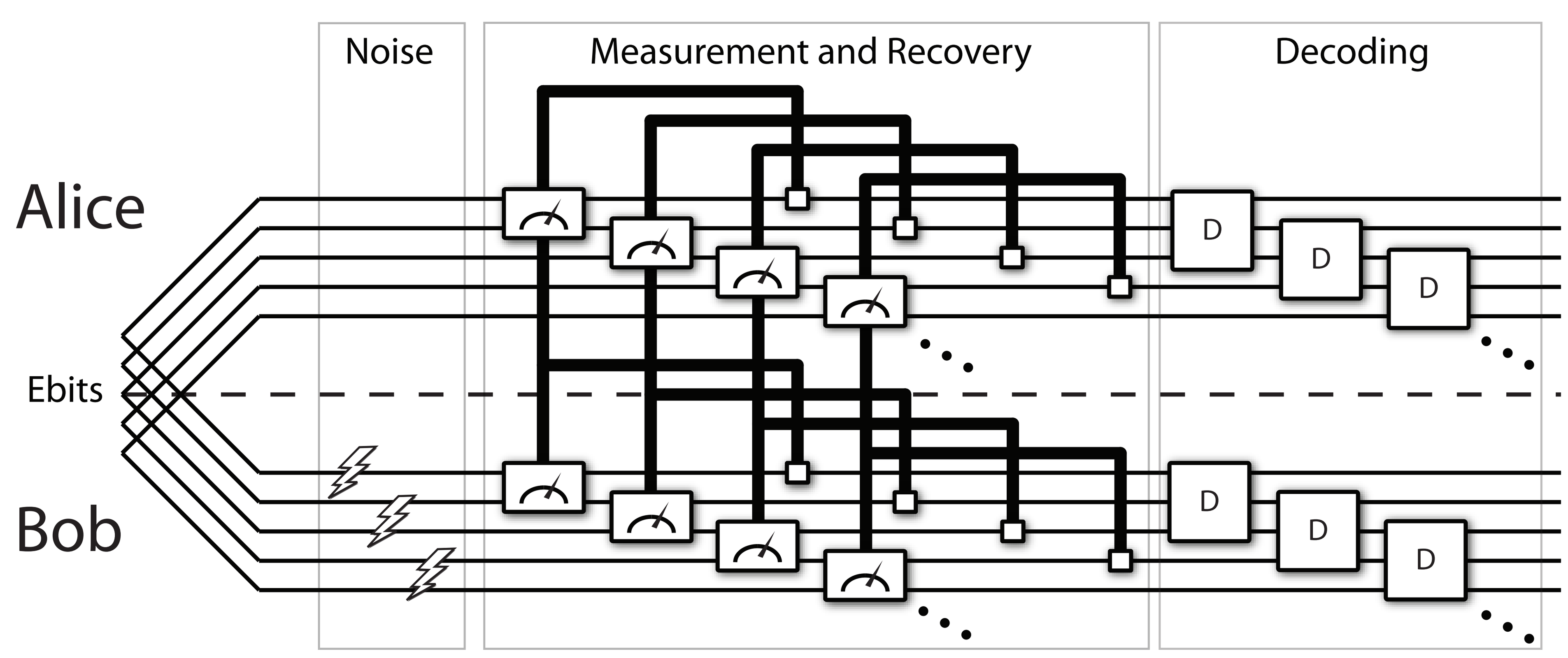


Linkabit
Founded 1968

QUALCOMM
Founded 1985

To '07

Quantum Communication



Quantum Cryptography

Quantum Teleportation

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QUANTUM INFORMATION THEORY

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Ideas empowered.