

KEY PROJECTS / SPONSORED RESEARCH IMPACT 4/2026

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Highlight. ***Deep Packet Inspection using FPGAs on FPX Platform: AI on 10Gbit Streams***

This began as my challenge to a junior research professor to put unix/linux pattern-matching software tools into his reconfigurable hardware.

It ended making massive profits on Wall Street for high-speed traders (ticker boxes); being a key technology of interest to intelligence agencies; and triggering a patent fight between two research groups at WashU.

A dozen graduate theses, dozens of papers, two companies (one working with the CIA, the other with the NSA/AFRL), multiple professors' tenure promotions, and much international press/notoriety surrounded this.

At its heart, it was the first Streaming AI (AI on data streams) project where reduced algorithmic complexity was key to embedding the intelligence in the data environment (prior AI sought complexity at the expense of speed). At one point the WUSTL group was beating FICO (Fair Isaac credit scoring) on performance.

Some of the patents that cite this work are assigned to Vertiv, Dell, Juniper Networks, HP, MainNerve, Protocol Acquisition, SiteSpect, Google, Fortinet, Throughputer, Amazon, Oracle, Cavium, IneoQuest, EMC, Gigamon, Lionic, Intel, FetchTech, IP Reservoir, Kuberre, Corel/JP Morgan Chase, SAP, Cisco, Roke Manor, Nokia, AT&T, Samsung, Canon, NetApp, Boeing, ETTRI, Advanced Micro Devices AMD, Sharp, SRC, GTB, NXP, IBM, Archeo Futurus, Global Velocity, and Exegy.

Highlight. ***McDonnell-Douglas F/A-18 E/F Super Hornet Sensor Suite Project Review Expert***

Company needed to show it was up-to-date and at-speed on AI ideas regarding sensor-fusion.

Main question for the external expert was what to think of the Stanford University MYCIN methods emerging from medical informatics for handling uncertainty.

Consultant advised against the trendy ideas, in favor of emerging imperfect (but sober) Bayesian methods. Had the engineering team pursued this now rejected way of representing and grading information, they would have lost important time tearing it out of software later. Company passed scrutiny of US Marine Generals armed with energetic critiques; project continued with renewed contract to production (these airplanes are currently in combat action).

Highlight. ***Summer Undergraduate Research Experiences for NSF***

Multiple years running a model program placing and mentoring students. College students from around the country placed in very active research labs in St. Louis. This raised the profile of WashU in CS, and St. Louis in innovative computing tech (friends of this program later founded *Square* in St. Louis which had been a sleepy tech entrepreneurial region, then soon produced people like Jack Dorsey of *Twitter* and Sam Altman of *OpenAI*).

Papers by students rivaled the mentoring professors' work after tracking students for a few years.

Arguably best outcome was the third founder of *Google*, who wrote the backrub webspider at Stanford for Sergey Brin and Larry Page in the next two years, after seeing how powerful scripting was in the medical library tech group.

Related to this outcome was our prototype for a citation-based data-harvest and -search engine that was perhaps mishandled by the university technology transfer office (they wanted to sell CDs to law firms rather than build web services like *FindLaw*, circa 1997; this was part of the Media-Lab-like digital libraries culture that WashU sent to Stanford through Steve Cousins and Scott Hassan).

Highlight. **Japanese *Fifth-Generation* AI Project Final Report**

Famous multi-year national priority for putting expert systems AI into hardware: a boondoggle in retrospect. They sought forensic review of what went wrong and what could be salvaged.

Japanese leading edge researchers needed to get back up on their feet and swing the bat again with confidence.

Report was clear-eyed about the problem (originating with out-of-date ideas in Silicon Valley). The problem was not poor execution by Japanese technologists.

A similar visit was done in Argentina after the fall of dictatorship to put their research universities in the fast lane of AI. They arguably now have the best groups doing in AI in South America, after starting from zero.

Highlight. ***Windowed White Listing and Dynamic Port Assignment* Computer Security**

An invention shopped to *Cisco* by the U Illinois Technology Transfer office.

This solved the problem of protecting webservers from malign actors who might exploit unsafe ports and out-of-date authentication protocols.

Now part of the suite of methods one can use for moving-target-defense (e.g., frequency-hopping wireless security).

Highlight. ***Visualizing Reference Classes in Data Science/AI/ML***

This is the current work that allows data analysts to audit a neural net or other ML method.

It allows the human a place in the analysis rather than assuming the machine is a fully trusted oracle. It beats Bayes Nets, Monte-Carlo dropout robustness analysis, ensemble methods, uninterpreted output weights, and classical statistical tests. It "solves" the eternal problem of finding the right *reference class* (and deciding *subset stability*) by reversing the question: not what is the *best* reference class, but when do the classes conflict so much that one *should not trust* the AI prediction.

This will be presented at the Case Business School's AI Symposium this month for corporate partners with an invitation to collaborate on intellectual property. Loui invites comparing the new Colvin-Loui diagrams to the famous Michelson-Morley experiments on Case's campus 150yrs ago.