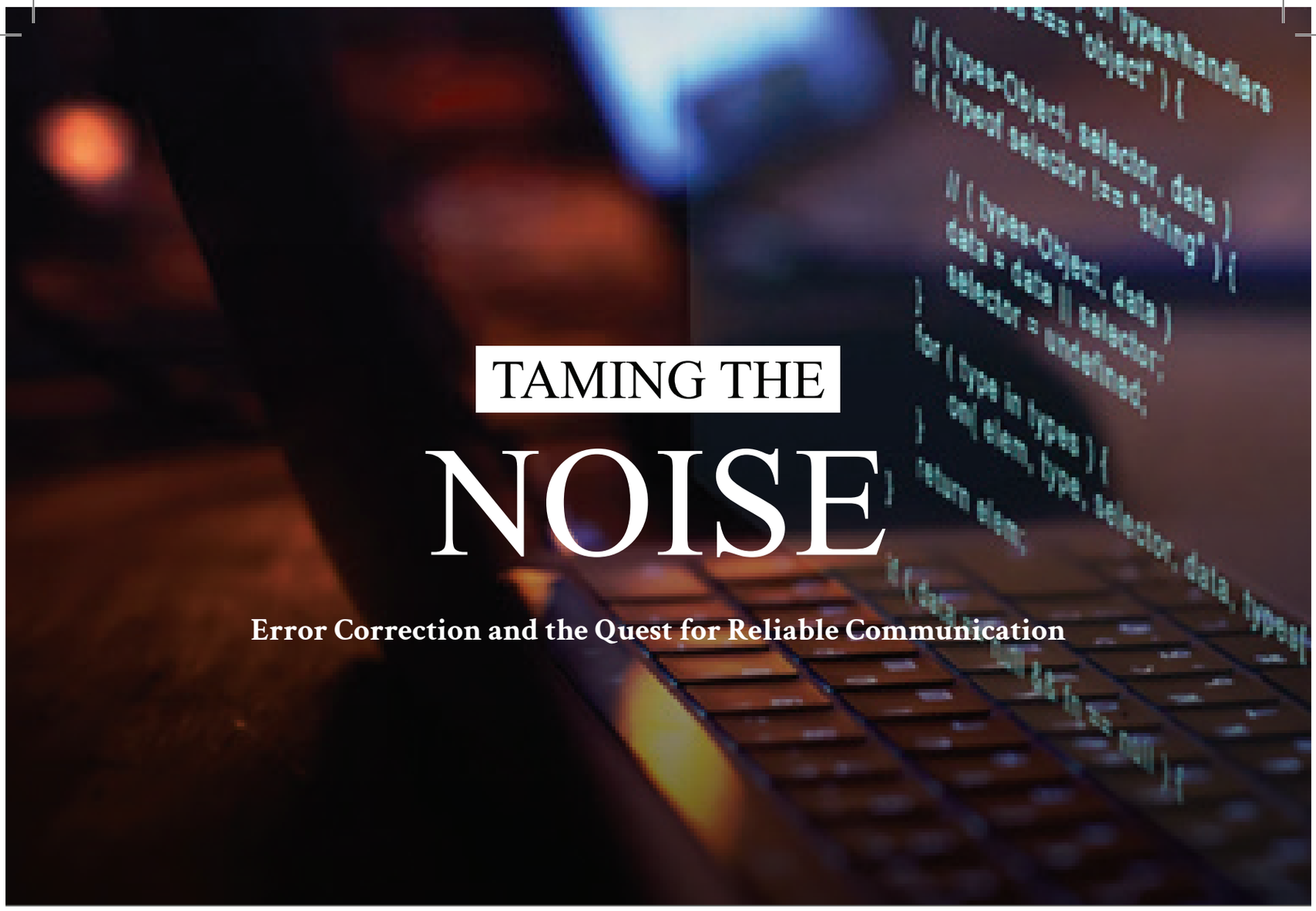

TAMING THE NOISE

Error Correction and the Quest for Reliable Communication

Have you ever marveled at how that mesmerizing sunset clip you sent to your friend across the globe arrives perfectly intact, despite traveling through countless wires and bounding between multiple satellites? The secret lies in a hidden world of error-correcting codes, unsung heroes of the digital age. These ingenious mathematical tools act like tiny data doctors, constantly patching up the inevitable glitches that occur during transmission. From that beautiful sunset to the secure transfer of your bank statements, error-correcting codes ensure our digital messages arrive clear and sound, making the magic of instant communication possible. "With billions of digital terabytes being shared each day, the need to ensuring reliability and data integrity has become even more critical," explains Prof. Noga Ron-Zewi.

Think of error-correcting codes as data shields, deflecting the errors that can plague information. These codes work by embedding redundant information within the data itself. But they are not just a practical tool. They are backed by a rich theory that connects the fields of mathematics, science, and engineering. A particularly successful partnership has been with computer science. This relationship has been a two-way street: computational methods have been instrumental in crafting efficient error-correcting codes, and conversely, these codes have found themselves powering a variety of tasks within computer science.

"Our project is poised to deepen these existing connections significantly. Our primary goal is to develop error-correcting codes that not only optimize the balance between redundancy and error-resistance, but also are paired with ultra-fast error-correction algorithms. We are convinced that these advanced codes will be key in enhancing the performance of critical computational processes."

The efficiency of these codes also directly impacts the sustainability of our digital infrastructure. Traditionally, servers store multiple copies of this data to ensure reliability. "By optimizing error-correcting codes, we can achieve the same level of data reliability with smaller server capacities. This reduction in server demand can lead to a significant decrease in the energy consumption of data centers, which are currently responsible for approximately 3% of global electricity usage." Enhancing the effectiveness and reliability of error-correcting codes is not just a technological challenge but a vital step towards more sustainable communication systems, contributing to reduced power consumption and a lower environmental footprint.

> ***The objectives we're tackling are ambitious. Achieving even partial success in these areas would mark a significant breakthrough, with implications for both theoretical and practical applications. We believe that we are uniquely positioned to make substantial progress toward more reliable and efficient data transmission - impacting everything from clearer video calls to faster downloads.***
>
> **-Prof. Noga Ron-Zewi**
> Department of Computer Science

Prof. Ron-Zewi was awarded the prestigious Krill Prize (2019) for her pioneering research. The Krill Prize celebrates and supports exceptional academic faculty members and up-and-coming researchers from Israeli research universities.

In 2022, she received a prestigious ERC Starting Grant to fund her innovative work in designing error-correcting codes. These grants are awarded by the European Research Council to talented researchers who are in the early stages of their careers.

Error-correcting codes serve as data shields, deflecting the errors that can plague information.