

## Popular science summary of the PhD thesis

PhD student	Mario Corral Bolaños
Title of the PhD thesis	Advancing quantitative imaging of white matter: from microstructure to pathways
PhD school/Department	DTU Compute

### Science summary

\* Please give a short popular summary in English (approximately half a page) suited for the publication of the title, main content, results and innovations of the PhD thesis also including prospective utilizations hereof. The summary should be written for the general public interested in science and technology.

The brain is less like a computer and more like a world-class pizza delivery service. For the perfect meal, the order does not just need to be fast, it needs to arrive exactly when you are hungry and before the crust gets cold. In our brains, this perfect timing is handled by *white matter*, a massive network of cables connecting different regions. These cables are coated in myelin, a fatty insulation that ensures electrical signals reach their destination at the exact millisecond required for us to think, move, or feel.

For decades, however, we have had a "resolution gap" in how we study this infrastructure. Doctors could use standard magnetic resonance imaging (MRI) to see the brain's overall shape (the "satellite view"), or microscopes to see a single cell (the "street view"). But we could not easily see the "traffic flow" of the massive highways connecting them.

My research contributes to bridge this gap by developing two new ways to characterize this infrastructure. First, we established a way to use advanced MRI to infer not just whether myelin is present, but how well it is structured and functioning as insulation. Second, we developed a new mesoscopic imaging technique to reconstruct the pathways of the whole rodent brain with micrometer precision without the need of slicing the sample into thin pieces, enabling us to see both the forest and the trees.

By characterizing the fine structural details of these neural pathways, we can better understand how our brain's "delivery service" remains synchronized in health and how it breaks down in disease, paving the way for earlier diagnoses and more precise treatments.

Please submit the summary to the department PhD coordinator together with your thesis