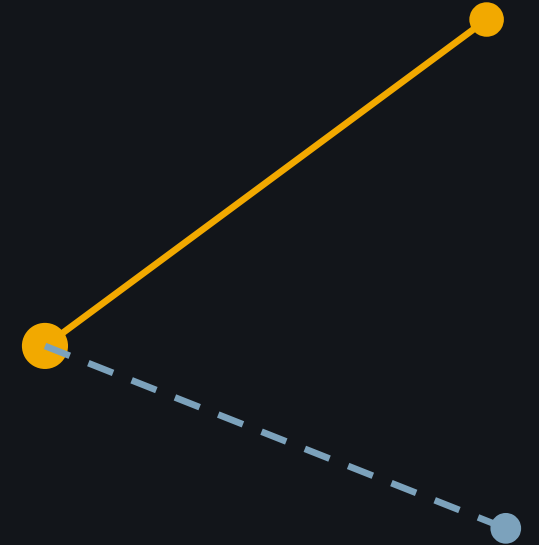


MATHEMATICS OF DISRUPTION · A SOUTH AFRICAN STORY

The Power of Choice

We determine the AI we want.

There is no single, inevitable future for artificial intelligence — only the one we choose to build.



The Fallacy of Inevitability

The dominant narrative treats today's AI as a fixed track laid down elsewhere — bigger models, more GPUs, more data — an outcome to consume rather than a decision to make.



“It's just progress.”

Each advance is framed as a law of nature unfolding — never as a series of human decisions that could have gone differently.



“Bigger is always better.”

Scale is presented as the only road forward, so the only question becomes who can afford the most compute.



“Resistance is futile.”

Whole regions and disciplines are told their role is to adopt the standard, not to question or reshape it.

*Yet every “inevitable” technology was once a choice **that beat its rivals — often for reasons that had nothing to do with being best.***



**Will you build me with wisdom,
or will you let others build me for you?**

— The Machine, Mathematics of Disruption

Inevitability is the most disempowering story we tell about technology. The alternative is harder, and far more hopeful: choice.

HISTORY'S VERDICT

Support Beats Merit

Again and again, the technology that “won” was not the best one. It was the best-funded, best-marketed, best-connected one. The “inevitable” standard was a contingent choice — decided by capital, ecosystems and politics.



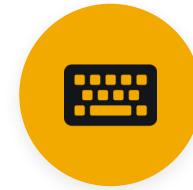
Electricity

Edison's DC vs Tesla's AC — settled by propaganda and capital.



Home Video

Sony's sharper Betamax lost to JVC's cheaper, open VHS.



The Keyboard

QWERTY was built to slow you down — and we still use it.

If “the best wins” were true, none of these stories would exist.

When Marketing Beat the Better Argument



Edison • Direct Current

Backed by the most famous inventor and deepest pockets of the age.

To defend it, Edison ran a fear campaign — staging public electrocutions and promoting the AC-powered electric chair to brand his rival as deadly.



Tesla & Westinghouse • AC

AC could be stepped up through transformers and sent over long distances cheaply.

It won the grid — but the fight was decided as much by money and showmanship as by physics.



And the “loser” was never wrong.

Today direct current powers data centres, solar arrays, batteries, USB and electric cars — and high-voltage DC now carries power further than AC ever could. The “settled” verdict was only ever partial.

When the Better Format Lost



Betamax vs VHS

THE BETTER ONE

Sharper picture, better build

THE ONE THAT WON

Longer tape, lower price & open licensing



HD-DVD vs Blu-ray

THE BETTER ONE

A genuine technical toss-up

THE ONE THAT WON

The PS3 install base + a single studio's deal



Dvorak vs QWERTY

THE BETTER ONE

A layout designed to stop jams

THE ONE THAT WON

Everyone already learned it — lock-in won

The pattern is the ecosystem, not the engineering: distribution, price, licensing and lock-in decide the winner.

AND THIS REACHES INTO SCIENCE ITSELF

Even Research Has Its Orthodoxies

The neural networks behind today's AI were once the heresy. The “respectable,” well-funded science of the day declared them a dead end.

1958



The Perceptron sparks early hope for learning machines.

1969



An influential critique helps freeze funding — the first “AI winter.”

1986



A handful of believers revive the idea with backpropagation.

2012



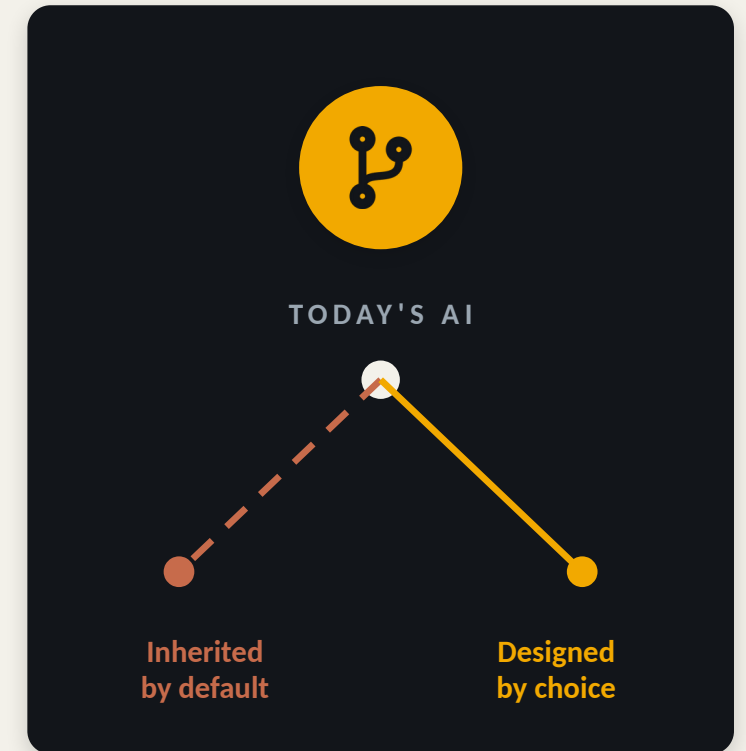
Deep learning wins decisively. The “dead end” becomes the mainstream.

Consensus is not the same as correctness. The future often hides in the idea the field has dismissed.

THE TURN

Today's AI Is a Choice, Not a Destiny

The same contingency runs through the machines we use now. Transformers, GPUs, gradient descent and the race to scale are engineering decisions made under pressure — efficient, profitable, and entrenched. They are not laws of mathematics. And what is chosen can be chosen differently.



The Cracks We Call Bedrock



Floating-Point Fragility

$$(a + b) + c \neq a + (b + c)$$

To gain speed, machines abandoned the exactness of real numbers. The book calls it the “original sin” of computing: even at temperature zero, batching shifts the order of operations and answers quietly drift. A choice made for efficiency — not a property of the universe.



Optimisation by Guesswork

$$\theta_{t+1} = \theta_t - \eta \nabla L(\theta_t)$$

We train models by stumbling downhill through a rugged landscape, blindfolded. Momentum and adaptive tricks help, but the book is blunt: they are heuristics without guarantees. Modern AI is “balanced on hacks” — a crude method we simply stopped questioning.

THE ROADS NOT TAKEN

The Mathematics Offers Other Paths

WHAT WE TREAT AS BEDROCK

Floating-point fragility

Gradient descent by trial and error

Correlation — prediction without understanding

Bloated models that memorise

Brittle, flattened representations

A patchwork of heuristics (“duct tape”)

WHAT THE MATHEMATICS ACTUALLY OFFERS

→ Posit arithmetic & resilient, low-power computation

→ Second-order methods & convex reformulation

→ Causal inference: reasoning about interventions

→ Compression & MDL — AI that runs on a phone

→ Geometry & topology — robust by design

→ Category theory — compositional blueprints

WHY THIS CHANGES THE GAME

Disruption Lives in the Math — Not the Hardware

A startup in Khayelitsha could train models as efficiently as Google.

You cannot out-spend Silicon Valley on compute. But a single breakthrough in optimisation or compression rewrites the economics of AI overnight — and that breakthrough is a mathematical idea, available to anyone who understands the foundations.



Compute is rented and fleeting.

Chips age, prices shift, vendors change.



Mathematics is permanent.

Master the principles and you stop chasing trends.



Elegance out-scales brute force.

The smallest true model is the most powerful.

THE CHOICE WE MAKE

Mathematical Sovereignty

Those who understand the foundations of AI can shape its future. Those who only consume it stay dependent. South Africa already holds the ingredients to choose the first path.



World-class universities

Wits, UCT, Stellenbosch & UP — deep maths and physics.



SKA in the Karoo

Quantum-scale computation and a frontier-science culture.



Eleven official languages

A natural laboratory for NLP no other country can match.



Urgent, real problems

Load-shedding, water and health turn constraints into research.



A young population

A demographic dividend — if we invest in the maths now.



Ubuntu values

A different compass for what AI should be built to do.

Ubuntu AI: Values Are a Choice Too

Eight technical pillars rest on one human foundation. How AI should serve people is not a technical default — it is decided.



Collective benefit over profit

AI for community health, not only shareholder value.



Transparency & explainability

Communities deserve to understand decisions made about them.



Inclusivity

Serving all eleven languages, all incomes, all regions.



Dignity

Technology that empowers people rather than replacing them.



Sustainability

AI that works within real energy and resource limits.

***“I am because
we are.”***

While others build AI for extraction,
we can build it for flourishing. That is
not only ethics — it is a competitive
advantage.

NOT AN ENDING — A BEGINNING

The Choice Before Us

The future of AI need not be written elsewhere. We have the minds, the problems and the values. What remains is the will — and the choice.



Students

Study the maths deeply; build for problems that matter here.



Government

Fund foundations, not just trends.
Keep talent at home.



Industry

Partner with universities; build products that work for Africa.



Civil society

Demand transparency. Hold AI accountable to communities.

*“Will you build me with wisdom — **or let others build me for you?**”*

Siyabonga. Re a leboga. Ngiyabonga. — The journey continues with each of us.