Unfelt Time

Why You Can't Feel Time Passing (Even Though It Does)

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The Strange Question I Asked

We can feel space:

- You know when you're moving forward vs backward
- You feel when you turn left or right
- You sense when you're going up or down

But we can't feel time:

- You don't feel yourself moving through time
- You can't sense time speeding up or slowing down
- You have no 'time sense' like you have spatial awareness

Einstein's Answer: Time Isn't Fixed

THE PHYSICS:

According to Einstein's relativity, time passes at different rates based on:

1. GRAVITY (Gravitational Time Dilation)

- Stronger gravity = slower time
- Weaker gravity = faster time
- Higher elevation = weaker gravity = faster aging

2. SPEED (Velocity Time Dilation)

- Faster movement = slower time

GPS wouldn't work without accounting for these relativistic effects

What I Built to Test This

THE DATA:

- 48,000 cities from around the world
- Latitude, longitude, elevation for each city
- Physics calculations for gravitational + velocity effects

THE MODELS:

- Computational physics simulation using Einstein's equations
- Neural network (TensorFlow) to predict time dilation
- Achieved $R^2 = 0.89$ (89% accuracy)

How Much Does Location Matter?

Time Dilation by City (microseconds per year):

La Paz, Bolivia (high altitude): +82 µs/year — Age FASTER

Denver, USA (mile high): +38 µs/year — Age FASTER

Chicago, USA (baseline): +2 µs/year — Nearly zero

Tokyo, Japan (sea level): -17 µs/year — Age SLOWER

Singapore (equator + sea level): -35 µs/year — Age SLOWER

1 microsecond = 0.000001 seconds | Over a lifetime (80 years), La Paz residents age 6.5 milliseconds more than Singapore residents

Why Can't We Feel This?

THREE REASONS:

1. THE EFFECTS ARE TINY

- Microseconds per year
- To notice 1 second difference takes ~30,000 years in La Paz

2. YOUR BRAIN SAMPLES REALITY IN CHUNKS

- Brain updates ~25 times per second (every 40 milliseconds)
- Anything faster than 40ms is invisible to consciousness
- Time dilation happens continuously, not in discrete jumps

Training AI to Predict Time Dilation

MODEL PERFORMANCE:

$R^2 = 0.89$ (explains 89% of variance)

MAE = 3.42 µs/year (average error)

RMSE = 5.18 µs/year

INPUT: Latitude, longitude, elevation

OUTPUT: Net time dilation in microseconds/year

WHY USE AI?

Physics equations are slow (trigonometry for every calculation).
Neural network learns the pattern once, then predicts instantly.
10x faster while maintaining accuracy.

Interactive Application Features

BUILT WITH STREAMLIT (Python web framework):

1. CITY COMPARISON TOOL
   - Select any 2 cities from 48,000 options
   - Instant predictions from neural network
   - Natural language explanations

2. PHYSICS VISUALIZATIONS
   - Global heatmap of time dilation
   - Proper time vs coordinate time plots

What This Project Shows

✓ PHYSICS & MATH: Einstein's relativity equations, coordinate transformations

✓ DATA ENGINEERING: Processing 48,000 cities, feature engineering from first principl

✓ MACHINE LEARNING: Neural network design, hyperparameter tuning, model evalua

✓ FULL-STACK DEV: Streamlit app, real-time predictions, responsive UI

✓ DATA STORYTELLING: Complex physics → simple explanations anyone can understan