\[
\frac{\partial^2 f}{\partial \theta^2} = -r \cos(\theta) \frac{\partial f}{\partial x} - r \sin(\theta) \left( -r \sin(\theta) \frac{\partial^2 f}{\partial x^2} + r \cos(\theta) \frac{\partial^2 f}{\partial y \partial x} \right) - \\
\quad r \sin(\theta) \frac{\partial f}{\partial y} + r \cos(\theta) \left( -r \sin(\theta) \frac{\partial^2 f}{\partial x \partial y} + r \cos(\theta) \frac{\partial^2 f}{\partial y^2} \right) \\
= -r \cos(\theta) \frac{\partial f}{\partial x} + r^2 \sin^2(\theta) \frac{\partial^2 f}{\partial x^2} - r^2 \sin(\theta) \cos(\theta) \frac{\partial^2 f}{\partial y \partial x} - \\
\quad r \sin(\theta) \frac{\partial f}{\partial y} - r^2 \sin(\theta) \cos(\theta) \frac{\partial^2 f}{\partial x \partial y} + r^2 \cos^2(\theta) \frac{\partial^2 f}{\partial y^2} \\
= -r \cos(\theta) \frac{\partial f}{\partial x} - r \sin(\theta) \frac{\partial f}{\partial y} + r^2 \sin^2(\theta) \frac{\partial^2 f}{\partial x^2} - \\
\quad 2r^2 \sin(\theta) \cos(\theta) \frac{\partial^2 f}{\partial y \partial x} + r^2 \cos^2(\theta) \frac{\partial^2 f}{\partial y^2}
\]
SCARED OF AI
FACTORY WORKER
CHEF
DRIVER
MICROWAVE COOKING OF AI

PRO
• Anybody Can Do It
• Turnkey Toolkits
• Free or Cheap Courses
• Runs on Laptop

CON
• Amateur = Dangerous
• Hard Problems
• Domain Expertise
• Sophistication
SOLVE ANY PROBLEM IN 4 STEPS

1. Define Goal
2. Data
3. Model (Less Wrong)
4. Decision / Presentation
LESS WRONG
Real world
(data and information, and problem to be solved)

conceptual model
(perception/expectation of system structure and processes)

Use data to build, calibrate model
(compare model output with observations)

Data

Model

Use model to guide data collection
(observation locations, sampling frequency, etc.)

Predictions (model output)
(model output reliability, solution to problem)
KNOWLEDGE GROWTH
SELF DRIVING CAR

Objective = Minimize drive time
Conditions =
- Don’t break laws
- Minimize Injury Risk

1. Camera Pixels >>> Deep learning >>> Stop Sign
2. Decision Tree >>> Stop required for legal condition
3. Breaking Amount >>> Minimize injury
4. Waiting Time >>> Drive Time + Injury Risk
WORLD DOMINATION FOR $4500
EXAMPLES

• Chemical Liability Risk
• Product Recommendation
• Self Driving
• Hedge Funds & Twitter
• Predictive Policing
• Real Estate Valuation and Brokerage
THANK YOU

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