**Artificial Intelligence:**

* Artificial Narrow Intelligence (ANI): AI’s that do one thing
  + Ex: Smart Speaker, Self-Driving car, Web Search etc
* Generative AI (Gen AI): General purpose AI
  + Ex: Chat GPT can be a copy editor, text summarizer, brainstorming partner etc.
* Artificial General Intelligence (AGI): Do anything a human can do
  + Still a long way from it

Machine Learning:

Supervised Learning

* Input to Output (A-B) mapping

|  |  |  |
| --- | --- | --- |
| **Input** | **Output** | **Application** |
| Email | Spam (0/1) | Spam Filtering |
| Audio | Text Transcripts | Speech Recognition |
| English | Chinese | Machine Translation |
| Ad, user info | Click or not (0/1) | Online Advertising |
| Image, radar info | Position of other cars | Self-Driving Car |
| Image of phone | Defect or not (0/1) | Visual Inspection |
| Sequence of words | The next word | Chatbot |

How Large Language Models (LLMs) work?

LLMs are built using supervised learning (A-B) to repeatedly predict the next word. When we train a very large AI system on a lot of data (Hundreds of billions of words), we get a Large Language Model like ChatGPT

How do you acquire data?

1. Manual Labeling
2. From Observing user, machine behaviors
3. Download from websites/partnerships

Data is messy

* Garbage in, garbage out
* Data problems
  + Incorrect labels
  + Missing values
* Multiple types of data
  + Images, audio, text

Machine Learning: Field of study that gives computers the ability of learn without being explicitly programmed

Data Science: Science of Extracting knowledge and insights from data

What makes a good AI company?

* Strategic Data acquisition
* Unified data warehouse
* Pervasive Automation
* Have new roles (Machine Learning Engineer) and Division of Labor

AI transformation:

1. Execute pilot projects to gain momentum
2. Build an inhouse AI team
3. Provide broad AI training
4. Develop AI strategy
5. Develop internal and external communications

What AI can and can’t do?

Anything you can do with 1 second of thought can probably now or soon automate

AI cannot predict stock prices accurately

AI cannot predict human intention based on their gestures or facial expressions

What makes an ML problem easier

1. Learning a ‘Simple’ concept
   1. Simple: need less than 1 second thought to reach conclusion
2. Lots of data available (A.B)

ML tends to work poorly when:

1. Learning complex concepts from small amounts of data
2. It is asked to perform on new types of data than the training data

Workflow of a machine learning project

1. Collect Data
2. Train Model: Iterate many times until good enough
3. Deploy Model
   1. Get Data Back
   2. Maintain/Update model

Key steps of a Data science project:

1. Collect Data
2. Analyze Data
   1. Iterate many times to get good insights
3. Suggest Hypotheses/Actions
   1. Deploy changes
   2. Reanalyze new data periodically

Brainstorming Framework

* Think about automating tasks rather than jobs Ex: Call center routing
* What are the main drivers of business value?
* What are the main pain points in your business
* You can make progress even without big data
  + Having more data almost never hurts
  + Data makes some businesses (Web search) Defensible
  + But with small datasets, you can still make progress

Due Diligence on project

|  |  |
| --- | --- |
| Technical Diligence | Business Diligence |
| Can AI system meet desired performance | Lower costs |
| How much data is needed | Increase Revenue |
| Engineering timeline | Launch new product or business |

Working with an AI team:

* Specify your acceptance criteria
  + Provide goal
  + Provide AI team a dataset on which to measure their performance
* Don’t expect 100% accuracy
  + Limitations of ML
  + Insufficient Data
  + Mislabeled data
  + Ambiguous Labels

Smart Speaker AI project:

Steps to process command

1. Trigger word/Wakeword detection Audio – Hey ‘Device’
2. Speech Recognition Audio – Tell me a joke
3. Intent recognition ‘Tell me a joke’
   1. Joke? Time? Music? Call? Weather? (Available intents)
4. Execute command

Self driving Car:

1. Image/Radar/Lidar/GPS/Maps
   1. Car Detection/Trajectory prediction
   2. Pedestrian detection/ Trajectory prediction
   3. Lane detection
   4. Traffic Light detection
   5. Obstacle detection
2. Motion Planning
   1. Steer/Accelerate/Brake

AI Transformation Playbook:

1. Execute pilot projects to gain momentum
   1. More important for the initial project to succeed rather than be the most valuable
   2. Show traction within 6-12 months
   3. Can be in-house or outsourced
2. Build an in-house AI team
3. Provide broad AI training
4. Develop an AI strategy
   1. Leverage AI to create an advantage specific to your industry sector
   2. Design Strategy aligned with the Virtuous Cycle of AI
      1. More users >> More data >> Beter Product
   3. Consider creating a data strategy
      1. Strategic data acquisition
      2. Unified data warehouse
   4. Create network effects and platform advantages
      1. In industries with ‘winner takes all’ dynamics, AL can be an accelerator
5. Develop internal and external communications
   1. Investor relations
   2. Government relations
   3. Customer/user education
   4. Talent/recruitment
   5. Internal communications

AI pitfalls to avoid

|  |  |
| --- | --- |
| Don’t | Do |
| Expect AI to solve everything | Be realistic about what AI can and can’t do given the limitations of tech, data, and engineering resources |
| Hire 2-3 ML engineers and count solely on then to come up with use cases | Pair engineering talent with business talent and work cross-functionally to find feasible and valuable projects |
| Don’t expect AI project to work the first time | Plan for AI development to be an iterative process, with multiple attempts needed to succeed |
| Expect traditional planning processes to apply without changes | Work with AI teams to establish timeline estimates, milestones, KPIs etc |
| Think you need superstar AI engineers before you can do anything | Keep building the team, but get going with the team you have |

Take your first steps in AI:

* Get friends to learn about AI
  + This course
  + Reading group
* Start brainstorming projects
  + No project is too small
* Hire a few ML/DS people to help
* Hire or appoint an AI leader (VP AI, CAIO etc.)
* Discuss with CEO/Board possibilities of AI transformation
  + Will your company be much more valuable and/or more effective if it were good at AI?

Limitations of AI:

* Bias
* Adversarial attacks
* Performance limitations
* Explainability is hard (but sometimes doable)

Combating Bias:

* Technical Solutions
  + Ex: ‘Zero out’ the bias in words
  + Use less biased and/or more inclusive data
* Transparency and/or auditing processes
* Diverse workforce
  + Create less biased applications

Adversarial attacks on AI:

* Minor perturbations (Minor changes)
* Physical attacks

Adversarial defenses

* Defenses do exist but incur some cost
* Similar to spam vs anti-spam, we may be in an arms race for some applications

Adverse uses of AI

* Deep Fakes
  + Synthesize video of people doing things they never did
* Undermining of democracy and privacy
  + Oppressive surveillance
* Generate fake comments
* Spam vs anti-spam and fraud vs antifraud

Solutions to job loss due to AI

* Conditional basic income: provide a safety net but incentivize learning
* Lifelong learning
* Political solutions