SWAPNEEL MEHTA, NYU CENTER FOR DATA SCIENCE

BUILDING A MACHINE LEARNING CAREER

WHY AM I STANDING HERE TALKING?

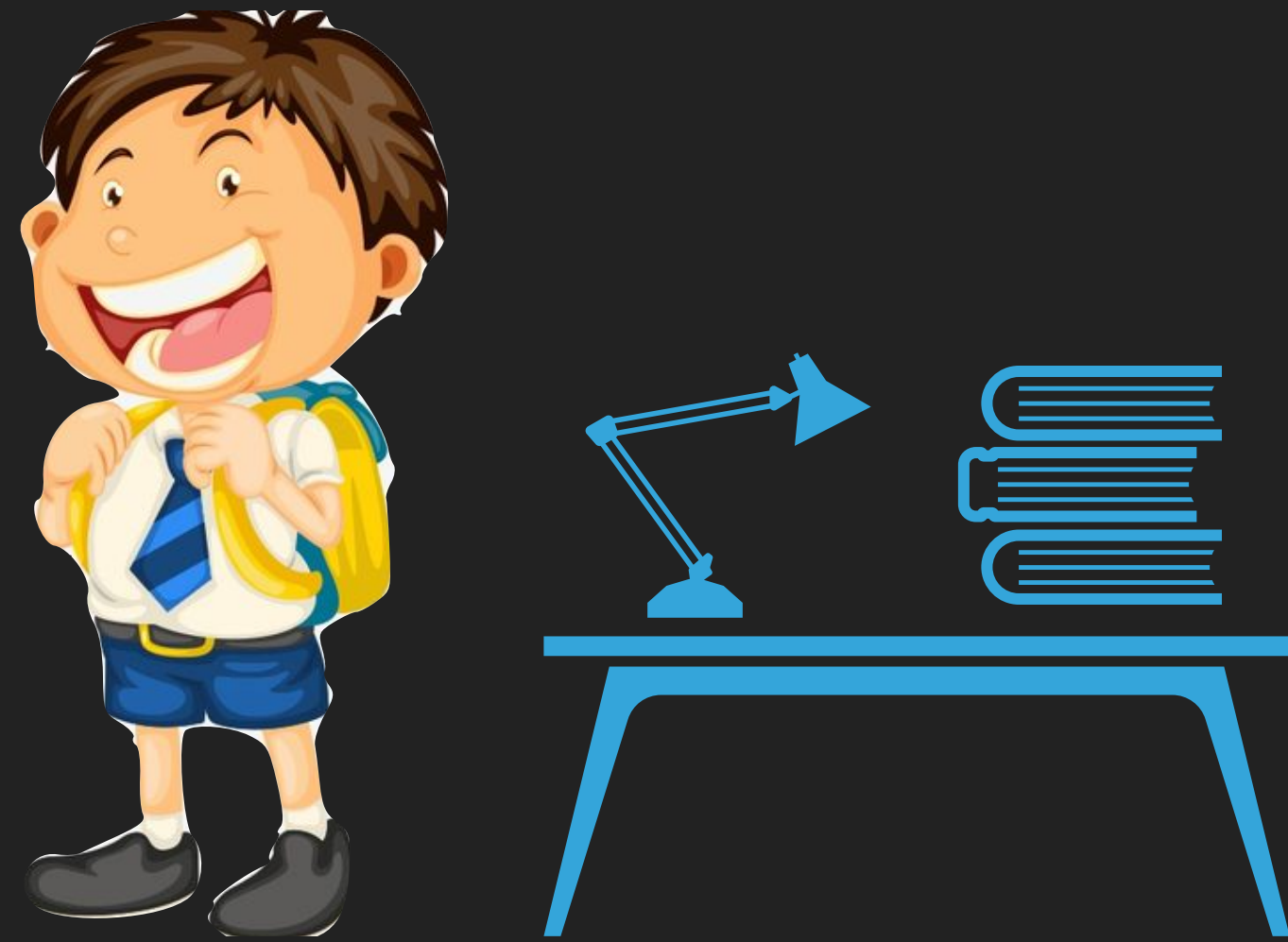## TLDR; NO IDEA.

▸ I don't have a serious "career in machine learning" myself

▸ No, really. I'm also looking for internships just like many of you

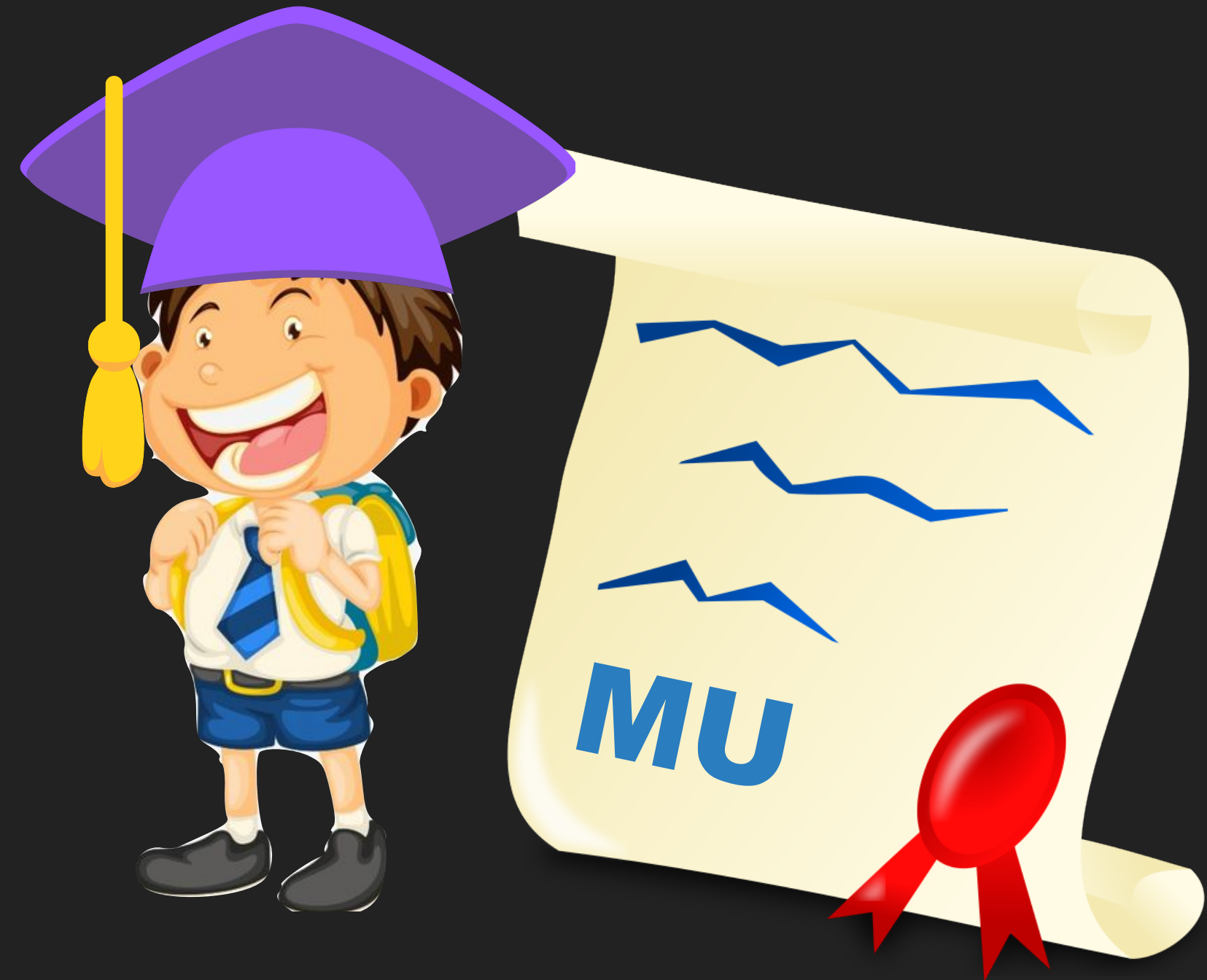▸ But in your Principal's defense, I have *some* experience allowing me to stand here and gab at you

BACKGROUND

▸ Ph.D. Student at the Centre for Data Science, New York University

▸ Researcher at the European Organisation for Nuclear Research (CERN)

▸ Worked at IIT Bombay with Microsoft Research

▸ Software Development at Smokescreen, CC Developers

WHAT DO HUMANS MEAN BY LEARNING?

**STATE WITH LESS
KNOWLEDGE OF TASK**

**STATE WITH MORE
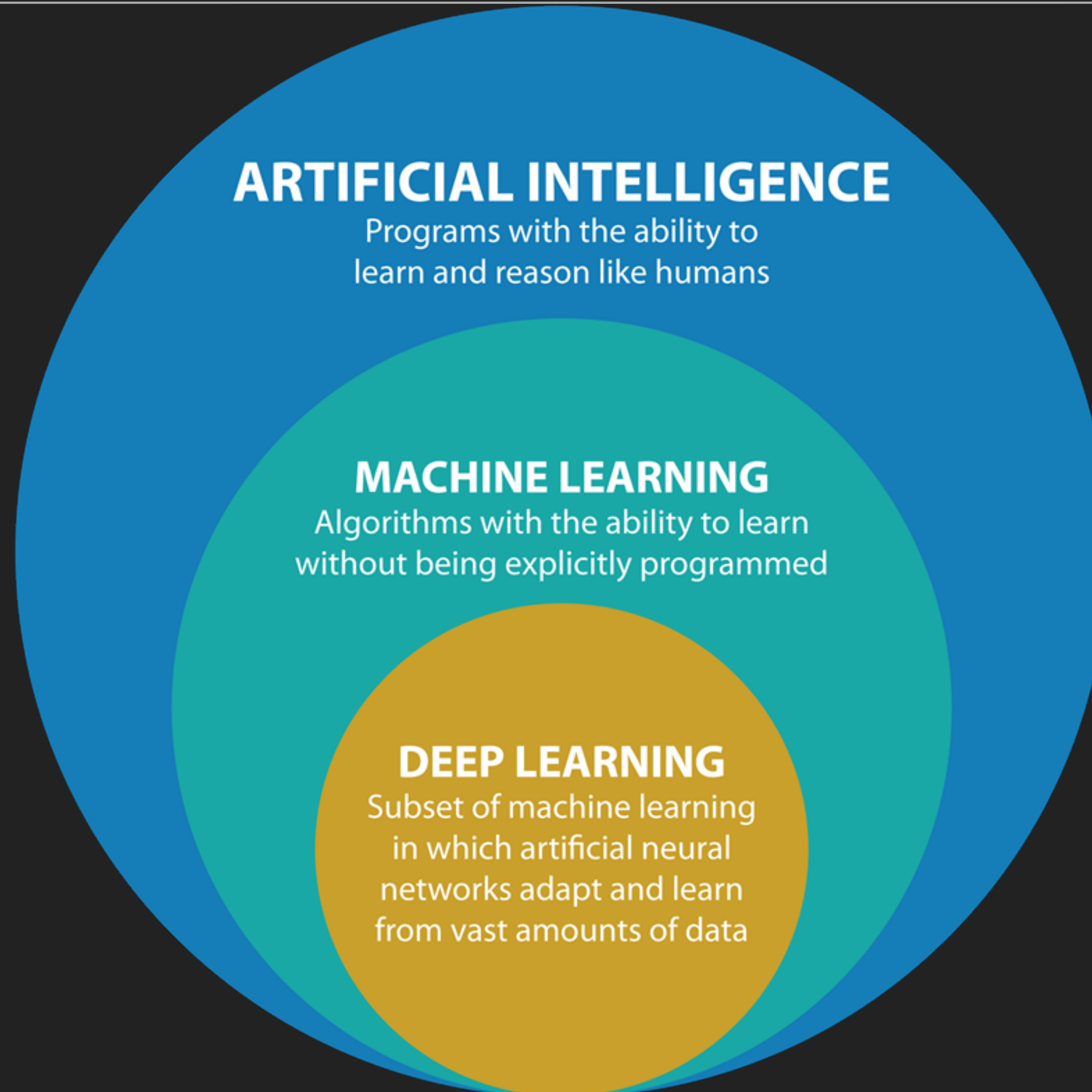KNOWLEDGE OF TASK**

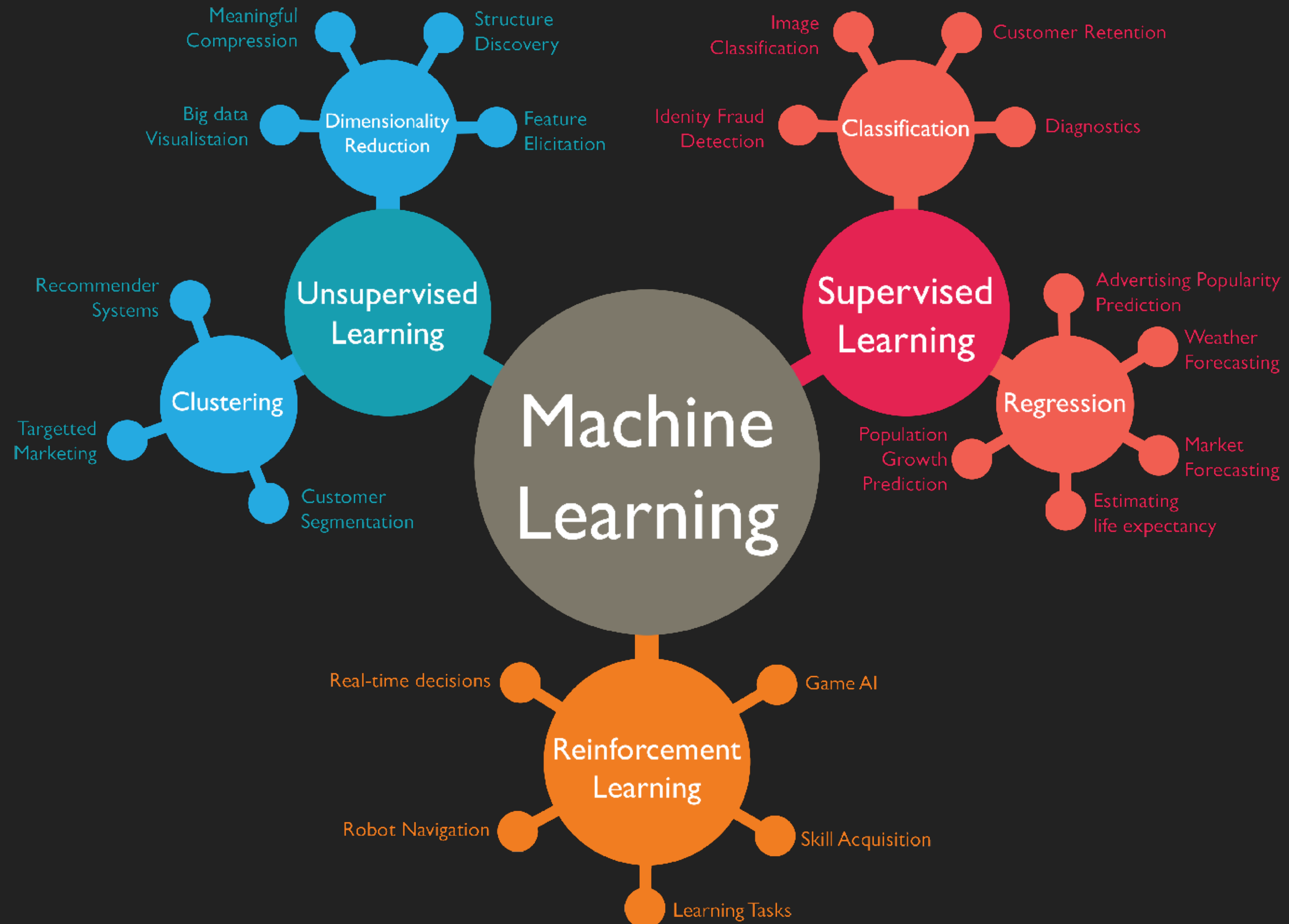OF COURSE IT IS UNCLEAR WHETHER AN M.U. DEGREE CONSTITUTES 'LEARNING'

WHAT IS MACHINE LEARNING?

▸ The science of getting machines to learn from 'experience'; **without being explicitly programmed to do so!**

WHAT ARE THE KEY REQUIREMENTS FOR MACHINE LEARNING?

▸ Data

▸ *Formalism; Problem Definition*

ARTIFICIAL INTELLIGENCE
Programs with the ability to
learn and reason like humans

MACHINE LEARNING
Algorithms with the ability to learn
without being explicitly programmed

DEEP LEARNING
Subset of machine learning
in which artificial neural
networks adapt and learn
from vast amounts of data

Source: Argility

Virtual Personal Assistant

Natural language processing

Deep Learning

Simulation Modelling

Machine Translation

Visualization

Artificial Intelligence

Social Network Analysis

Audio Analytics

Graph Analytics

Image Analytics

Internet of Things

Robotics & Soft Robotics

Machine Learning

source statista via @mikequindazzi

AI/ML JOBS

▸ Engineering

Building the tooling, infrastructure, data flows, and implementations of machine learning models.

▸ Research

Designing and performing experiments to answer questions about the potential of machine learning to solve a problem.

RESEARCH VS. ENGINEERING

- Design, develop, test, deploy, maintain and improve software.
- Manage individual project priorities, deadlines and deliverables.

SOFTWARE ENGINEER

- Participate in cutting edge research in machine intelligence and machine learning applications.
- Develop solutions for real world, large scale problems.

RESEARCH SCIENTIST

- Work with large, complex data sets. Solve difficult, non-routine analysis problems, applying advanced analytical methods as needed. Conduct analysis that includes data gathering and requirements specification, processing, analysis, ongoing deliverables, and presentations.
- Build and prototype analysis pipelines iteratively to provide insights at scale. Develop comprehensive knowledge of Google data structures and metrics, advocating for changes where needed for product development.
- Interact cross-functionally, making business recommendations (e.g., cost-benefit, forecasting, experiment analysis) with effective presentations of findings at multiple levels of stakeholders through visual displays of quantitative information.
- Research and develop analysis, forecasting, and optimization methods to improve the quality of Google's user facing products.

DATA SCIENTIST, ENGG.

HOW TO GET INTO ML ENGINEERING

▸ Practice, practice, practice.

▸ kaggle.com, fast.ai, metacademy.org

▸ Learn from tutorials, build your own modifications on top

▸ Unfortunately there is a glass ceiling* - you can only do so much "without knowing the math"

▸ Online courses are not that useful (more on next slide)*

* personal opinion only, I could be wrong

HOW TO GET INTO ML RESEARCH

▸ You need to know the math!

▸ Take a Probability and Statistics Class before diving into ML/DL

▸ Unpopular Opinion:
YouTube (Course vids) + Presenter Slides >>>> Coursera, Udacity, Udemy*

▸ Caveat: Learning from YouTube is a lot more taxing because no structure

▸ Having a Ph.D. usually helps break the glass ceiling.

* personal opinion, look up videolectures.net

HIGHLY OPINIONATED ADVICE FOR (INDIAN) UNDERGRADS

▸ Finding your passion is overrated. Find things that you definitely don't like doing, instead!

▸ Stick to reference books if you want to really learn!

▸ Certificates don't matter. Find more direct ways to demonstrate your capabilities to universities and employers e.g. Kaggle contest, Hackathons

▸ If you put a gun to my head about MS/PhD admissions metrics:
Research ~ GPA > Letter of Reference ~ GRE Score > SoP ~ Internships *

* if letter is from reputed source, it gains top priority; if internship is at well-known firm then it gains more weightage.

REALITIES IN MACHINE LEARNING

▸ The core field is <u>oversaturated</u> - the last ML Conference sold out faster than most major concerts (11 min!)

▸ Applied ML is far from saturated e.g. ML + Natural Sciences (Physics, Chem, Bio; also Geology, Climate, Marine Engg., etc.)

▸ Lots of online resources; unlike most fields, it is possible to be entirely self-taught! But, read "<u>Being an independent ML Researcher</u>" for a reality check.

▸ Spoiler: It has a section called "A lonely life, not losing my sanity or hope"

HAS AI JUST BECOME HYPE?

TECH \ ARTIFICIAL INTELLIGENCE

Forty percent of 'AI startups' in Europe don't actually use AI, claims report

Companies want to take advantage of the AI hype

Why It's So Hard to Bring Artificial Intelligence to Your Business

If you think everyone else is using AI, don't worry. They're probably doing it wrong.

Facebook's Virtual Assistant 'M' Is Super Smart. It's Also Probably a Human.

M is the man! (Like, literally ...)

The rise of 'pseudo-AI': how tech firms quietly use humans to do bots' work

Using what one expert calls a 'Wizard of Oz technique', some companies keep their reliance on humans a secret from investors

BUSINESS \ TECH \ ARTIFICIAL INTELLIGENCE

This AI startup claims to automate app making but actually just uses humans

Who could have seen that coming?

TIPS AND TRICKS

▸ Focus on your syllabus, not just grades!

▸ Join Twitter - follow the ML Community

▸ Build an online presence - Blog, LinkedIn, Github

▸ Use your unfair advantage

▸ Most critical skill? Communication

▸ You either have good experiences or good learning experiences. There is no bad experience, so try different things!

QUESTIONS?

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REALITIES OF PURSUING HIGHER EDUCATION

▸ Academia as well as Industry are plagued by commensurate systemic issues

▸ The grass always seems greener on the other side; even when you get to "the other side"

▸ **Living alone, studying tough subjects is not easy.** Grad school is going to be a hard experience for many of us (but it will be incredibly rewarding!)

▸ Overall I highly recommend gaining experience for a year before jumping into a Masters (if possible)