Carnegie Mellon University Africa
Certificate I: Understanding AI and Machine Learning in Africa

Course AIML02: AI and Machine Learning in Africa

Module 3: AI Business Strategy
Lecture 3: Collaborative Intelligence – Humans and AI are Joining Forces

Welcome back to Module 3 of AI and Machine Learning in Africa, a course which provides an overview of the relevance of AI and machine learning to Africa and their potential to solve economic and social problems.

In this third lecture we pick up on a central theme of this and previous courses: the collaborative nature of the relationship between humans and AI. We met this idea in the first lecture of Module 1 in both AIML01 and the current course, AIML02. It forms a central plank of the fourth industrial revolution.

Here, we will summarize the key points of an article by James Wilson and Paul Daugherty

"Collaborative Intelligence – Humans and AI are Joining Forces"

We begin by exploring the value of collaboration. We then identify three crucial roles humans perform when interacting with smart machines, followed by three ways smart machines can help humans expand their abilities.

We assess the implications of reimagining your business when adopting AI and identify five elements of business processes that can be improved by collaboration between humans and AI. This gives rise to the need for new roles and talent.

We finish up by summarizing what we have covered and providing the details of the article that you should read to consolidate what you have learned.

After watching and listening to this lecture, you should read the original article, take notes, and then go through this lecture again to consolidate the messages in the article.

We have five learning objectives, so that, after studying the material covered in this lecture, you should be able to do the following.

1. Highlight the value of collaboration between humans and artificial intelligence, and identify five principles that can help companies benefit from optimizing collaboration.

2. Explain the three roles performed by humans, in which humans assist machines.

3. Explain the three roles performed by machines, in which machines assist humans.

4. Identify five characteristics of business processes that companies typically seek to improve using AI.

5. Explain why reimagining business processes to exploit collaborative AI also creates a need for new roles and talent among employees.

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"Collaborative Intelligence – Humans and AI are Joining Forces"

Slide 2 The article by Wilson and Daugherty opens by highlighting that

"Never before have digital tools been so responsive to us, nor we to our tools."

As a powerful tool, AI will fundamentally change how work is done and who does it

But AI will have its biggest impact, not in replacing humans, but in complementing and augmenting human capabilities.

Recall from Module 1, Lecture 1, that humans use tools to amplify their capabilities: AI is just an extremely powerful cognitive tool used in the service of people.

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Slide 3 Wilson and Daugherty go on to say

"In our research involving 1,500 companies, we found that firms achieve the most significant performance improvements when humans and machines work together."

Slide 4 When humans and AI work together successfully, using collaborative intelligence, they actively enhance each other's complementary strengths

Human strengths are leadership, teamwork, creativity, and social skills

AI Strengths are speed, scalability, and quantitative capabilities.

What comes naturally to humans is often difficult for machines;

Conversely, what is easy for machines is often virtually impossible for humans

Business needs the capabilities of both

Slide 5 To be successful in adopting AI, companies must understand

How humans can effectively complement machines

How machines can enhance what human capabilities

How to redesign business processes to support the partnership

Slide 6 Five principles can help companies benefit from optimizing collaboration between humans and artificial intelligence

1. Reimagine business processes
2. Embrace experimentation and employee involvement
3. Direct AI strategy actively
4. Collect data responsibly
5. Redesign work to incorporate AI and cultivate related employee skills

Slide 7 A survey of 1,075 companies in 12 industries found that the more of these principles they adopted, the better their AI initiatives performed in terms of speed, cost savings, revenue, and other operational measures

Slide 8 Humans play three crucial roles.

They must train machines to perform certain tasks

Explain the outcomes of those tasks, especially when the results are counterintuitive or controversial

Sustain the responsible use of machines, by, for example, preventing robots from harming people.

Slide 9 Machine learning algorithms must be taught how to perform the work for which they are designed.

These training data sets are typically huge.

In addition, AI systems must be trained how to interact effectively with humans.

For example, Microsoft's AI assistant, Cortana, required extensive training to exhibit just the right personality: "confident, caring and helpful, but not bossy."

This took many hours of work by a team that included a poet, a novelist, and a playwright.

Slide 10 Human trainers were also involved in training the personality of Apple's Siri and Amazon's Alex to ensure they reflected the brand image of these companies.

Slide 11 According to Wilson and Daugherty, Siri has just a touch of sassiness, as consumers might expect from Apple.

AI assistants are now being trained to display even more complex and subtle traits, such as sympathy.

Slide 12 AI systems, and deep neural network machine learning systems, in particular, suffer from the so-called black-box problem:

the conclusions they reach are opaque, that is, the basis for a conclusion is not open to scrutiny in any straightforward manner
(refer back to AIML01, Module 1, lecture 3).

Consequently, humans are required to explain the behavior of the AI system to nonexpert users.

Slide 13 Such explanations are particularly important in sectors and industries that require evidence,

such as law and medicine.

They are also needed in regulated industries where the machine's output could be challenged in court.

The European Union's General Data Protection Regulations (GDPR) gives consumers the right to an explanation for any algorithm-based decision, such as the rate charged on a credit card or a mortgage.

Slide 14 Companies also need "sustainers"

These are the people who work to ensure that AI systems are working properly, safely, and responsibly.

Expert safety engineers work to ensure that AI systems don't pose a threat to humans.

For example, they might be need to ensure that robots that work alongside people – these are sometimes referred to as cobots, for collaborative robots – don't perform dangerous movements.

Slide 15 Other experts focus on the ethical behavior of AI systems: to ensure that there is no implicit or explicit bias in the models or the decision that the models produce.

Slide 16 Yet other experts work to ensure that AI systems are compliant with regulations, such as GDPR,

and that privacy and confidentiality are respected, especially concerning the data used to train the system.

Slide 17 The goal of a company's "differential privacy team" is to ensure AI systems learn as much as possible from, say, user data, but also ensure that the user data remains private.

Slide 18 Smart machines help humans expand their abilities in three ways

Amplifying cognitive skills

Interacting with customers (and thereby leaving employees free to focus on other tasks)

Embodying and extending human physical skills

Slide 19 AI can boost analytical skills and also enhance creativity

For example, Dreamcatcher from Autodesk takes the criteria provided by a designer, e.g., a chair's loadbearing capacity, height, and cost, and produces thousands of designs that match the criteria.

The designer can then iterate through new options by tweaking the criteria or flagging unacceptable results.

This way, the designer exercises professional judgement and sense of the aesthetic, leaving the work of suggesting possible designs to Dreamcatcher

Slide 20 Human-machine collaboration enables companies to interact with employees and customers in new and more effective ways.

For example, AI agents such as Microsoft's AI assistant, Cortana, could enhance communications by transcribing a meeting and making a voice-searchable version available people who were not able to attend.

Slide 21 SEB, a major Swedish bank, uses a virtual assistant called Aida to interact with millions of customers.

Aida can answer many frequently asked questions and ask callers follow-up questions to help solve their problems.

It is able to analyze a caller’s tone of voice and use that information to provide better service later.

Human representatives can then concentrate on calls from customers with more complex issues.

Slide 22 AI applications such are Aida, Cortana, Alexa, and Siri are software agents.

However, some AI systems, such as robots, are physically embodied.

We already mentioned cobots: collaborative robots that work alongside people.

Cobots are smart, context-aware robots that can handle repetitive actions that might require heavy lifting,

while the person it's working with performs complementary tasks that require dexterity and human judgment, such as assembling a gear motor.

Slide 23 In order to get the most value from AI, operations need to be redesigned.

There are three steps in this process.

First, companies must identify opportunities for improvement.

They need to discover and describe an operational area that can be improved, such as slow recruitment processes or identify adverse drug reactions across populations of patients.

Slide 24 Former U.S. Defense Secretary Donald Rumsfeld once famously distinguished among “known knowns,” “known unknowns,” and “unknown unknowns”—things you’re not even aware you don’t know.

Quite often, the opportunities might be invisible, involving things the company doesn't even know it doesn't know: the "unknown unknowns".

Slide 25 Some companies are now using AI to uncover unknown unknowns in their businesses.

For example, GNS Healthcare applies machine-learning software to find overlooked relationships among data in patients’ health records and elsewhere.

After identifying a relationship, the software produces hypotheses to explain it and then suggests which of those are the most likely.

This approach enabled GNS to uncover a new drug interaction hidden in unstructured patient notes.

Their machine learning system didn't just mine data to identify patterns and correlations in data: it discovered causal links.

Slide 26 Step 2 is to develop a solution through co-creation

In this step, you engage stakeholders to envision how they might collaborate with AI systems to improve a process.

One large agricultural company wanted to deploy AI technology to help farmers using their data on soil properties, weather patterns, historical harvests.

Their initial plan was to develop an AI application that would predict future crop yields.

But in discussions with farmers, the company learned of a more pressing need. What farmers really wanted was a system that could provide real-time recommendations on how to increase productivity

which crops to plant, where to grow them, how much nitrogen to use in the soil, and so on.

The company developed an AI system to provide such advice, and the farmers were happy about the crop yields obtained with the AI's guidance.

Results from the initial test were then fed back into the system to refine the algorithms used.

Slide 27 The third step for companies is to scale and then sustain the solution

SEB, for example, originally deployed a version of Aida internally to assist 15,000 bank employees but then rolled out the chatbot to its one million customers.

Slide 28 There are five characteristics of business processes that companies typically want to improve.

Slide 29 The first is flexibility

To cater for demand for individualized luxury cars,

a demand their assembly systems couldn't accommodate,

Mercedes-Benz replaced some of its conventional robots with AI-enabled cobots

and redesigned its processes around human-machine collaboration.

At the company's plant near Stuttgart, Germany, cobot arms, guided by human workers, pick up and place heavy parts, becoming an extension of the worker's body.

This system puts the worker in control of the build of each car, doing less manual labor and more of a "piloting" job with the robot.

Mercedes can individualize vehicle production according to the real-time choices consumers make at dealerships.

As a result, no two cars rolling off the assembly line at the Stuttgart plant are the same.

Slide 30 For some business activities, speed is the key;

for example, when detecting fraudulent credit card translations.

An AI system used by Danske Bank improved its fraud-detection rate by 50% and decreased false positives by 60%.

The reduction in the number of false positives frees investigators to concentrate their efforts on difficult-to-classify transactions flagged by the AI system and requiring human judgment.

Slide 31 The third characteristic is scale.

For many business processes, poor scalability is the primary obstacle to improvement because they are heavily dependent on human labor.

AI can help by taking automating some of the work, leaving critical decisions to people.

Unilever combined human and AI capabilities to increase the number of potential recruits it can process,

In the first round of the application process, candidates are asked to play online games that help assess traits such as risk aversion.

On the basis of their performance, the AI system determines which individuals might be best suited for a particular position.

In the next round, applicants are asked to submit a video in which they answer questions designed for the specific position they're interested in.

Their responses are analyzed by an AI system that considers not just what they say but also their body language and tone.

The best candidates, as judged by the AI system, are then invited for in-person interviews, after which humans make the final hiring decisions.

Slide 32 AI can help people make better decisions by providing them with key information and helpful guidance.

For example, digital twins, i.e., virtual models of physical systems, can be used to predict upcoming problems in a wide variety of processes, especially when linked to machine learning.

This fundamentally alters the decision-making process.

Slide 33 Companies aim to provide customers with individually tailored brand experiences.

AI makes this personalization possible with great precision and on a very large scale.

Recommender systems for streaming audio and video services are typical examples.

The key is the power of AI to analyze user data and make accurate predictions of user preferences.

Slide 34 Reimagining a business process involves more than the implementation of AI technology;

it also requires a significant commitment to employee development, helping employees learn what are referred to as “fusion skills":

the skills that employees need to work effectively at the human-machine interface.

Slide 35 Wilson and Daugherty conclude by stating that

"We expect that in the future,

company roles will be redesigned around the desired outcomes of reimagined processes,

and corporations will increasingly be organized around different types of skills

rather than around rigid job titles."

To summarize:

1. Organizations that use machines merely to displace workers through automation will miss the full potential of AI.

2. Successful companies will embrace collaborative intelligence, transforming their operations, their markets, their industries, and their workforces.

3. Effective AI strategies will focus on

    - How humans can effectively complement machines.
    - How machines can enhance human capabilities.
    - How business processes can be redesigned to support the partnership.
    - Targeting flexibility, speed, scale, decision making, and personalization.

Here is the article on which this lecture is based. Please take the time to read it and then review this lecture again.

Wilson, H. J. and Daugherty, P. (2019). Collaborative Intelligence: Humans and AI Are Joining Forces, in Insights You Need from Harvard Business Review – Artificial Intelligence, Harvard Business School Publishing Corporation, pp. 109-134. https://hbr.org/2018/07/collaborative-intelligence-humans-and-ai-are-joining-forces