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**Cyber Course, Professor Eviatar Matania**

**From the Industrial Revolution to the Cyber Era**

* The industrial revolution was based on the transition from fuel to energy, and later from products to services.
* The entire field of fuel and energy compose some 20% of GDP, and the rest is services.
* The global and economic struggle is moving towards knowledge and information.

**Subjects for Today's Lesson:**

* Advanced algorithms and AI for deep learning (DL).
* Social implications, mainly from the perspective of democracy.
* The work force - human resources.
* The double global race to achieve superiority in the cyber era, compared to the industrial period.

**Big Data and AI – Deep Learning Algorithms**

* Since 2012, there has been a substantial transformation, the connection between data and algorithms. Thanks to cyber, everything is connected, integrated with computing, information is collected in very large amounts, and sensors are everywhere (specifications, computers, cameras, etc.).
* The implication - the algorithms work is based on the presentation of a many events, and learns from within them. There is no common method for identification, but there is the ability to learn based on a massive presentation of "what is correct" and "what is incorrect".
* This is a very complex world, and creates significant ethical questions concerning "learning systems" - they should not be allowed to be created by the technical world, but rather by the academia, etc.
* The expected use of DL algorithms:

1. **Decision** support, it can look at large amounts of data and provide assistance (bank mortgage officer, judges, etc.). However, there will be other significant questions, what if the "human" decision differs from the system's recommendation? Who will enjoy more legitimacy? The human or the system? What about the medical field? Will the system's recommendation prevail over a doctor's analysis and recommendation?
2. The **decision-making** process in real time, such as in vehicles, aircraft, etc. This field creates challenges when there are accidents, casualties or unfortunately, fatalities. Who will "go on trial"? We do not sufficiently understand the future significance and implications of this.
3. **Research** - in academia and industry to reach cardinal decisions.
4. **Data Analysis and Optimization**.

* The Chinese carried out an experiment for a social behavioral "ranking" system for management and enforcement while violating individual privacy and collecting habit-based information (e.g. consumer, purchasing, etc.). These behaviors resulted in a score being given to define what a person can and cannot do.
* Israel has taken many steps on this subject; today there is ranking in the vehicle insurance industry, which affects the premium levels, and also in the vehicle leasing industry.
* More and more algorithms are being created that can be used on several data bases, and this is a developing field.
* How the risk to democracy be reduced:

1. Do not build data repositories if they are not required.
2. Regulation - what can be collect, what cannot be collected, who can view the information, etc.
3. Technological means - the number or repositories, etc.

There is currently little information on the subject, too little research in this area. There is no problem with repositories containing a lot of information of a few people.

**Where to next?**

* Technology is "galloping" forward.
* The influence on freedom and human rights.
* Who decides on this issue?
* It is recommended to create public-government-academia collaboration.

**The post-industrial era** - AI technologies, cyberspace has created the possibility to create advanced algorithms by using DL.

**Another social issue - the workforce** - how will the use of algorithms influence the global workforce.

* Kai Fu Lee - introduced the theory that distinguishes between **complex** and **non-complex** tasks (radiologist compared to a CEO), a **creativity** component had to be added. He claims that repeated tasks will be replaced by AI and robots; concerning tasks with a high-level of creativity or those that are complex, they will not be replaced by robots.
* He adds an additional dimension in his analysis of the future workforce, and in addition to the previous components, professions requiring compassion are professions that not only will not be replaced by the robots, there needs to be more of them!
* This conclusion will not only influence us as individuals and as a society, but also on the subjects taught in the education system and the way the younger generation is being trained.
* Considering the understanding that there will be many more people that work, how will we plan our "entertainment culture"?
* The assumption is that less people will be required for many professions, but many new professions will be created. A large part of the transition will for technicians and those employed in the entertainment industry, which will require the state to make changes. What will remain and "hold its ground"? "organized work" and initiatives.

**The Double Global Race for Digital Cyberspace Superiority**

* Includes the inclusion of cyber as a phenomenon, as a domain. The dramatic consequences on global economies.
* The movement of power that is taking place in the international system -
* What is power in the era of the industrial revolution.

1. Power was built by infrastructure (e.g. trains)
2. Capital (e.g banks)
3. The technological world (e.g. engineers).
4. A steady government, advanced regulation, courts.

* What is power in the era of cyberspace? It is an attempt to compare:

1. Building **infrastructures at a very high standard**: communication infrastructures are critical, information storage (e.g. the cloud), super-computers, parallel computing.
2. Comparison to the financial system in the industrial era - **a complete ecosystem** of inovation, enterprise, start-ups and someone to finance it (a start-up is based on capital and not machines).
3. Comparison to mechanical engineers in the industrial era - computer scientists, software developers - all in large numbers. Between science (mathematics, physics) and computer engineering, software and electronics. These are the main professions in the era of cyberspace.
4. Building a data "regime".
5. Building **military power** in cyberspace.

The more a country is more deeply involved in each of these areas, it will turn it into a more significant superpower in the global arena.

**The claim that there are two parallel races being carried out:**

1. **The military race** - the main players are the USA, China and Russia, with Britain, Israel and other close behind.
2. **The techno-economic race** (the ability to build an an advanced economy in the cyber era that is AI based) - the main players are the USA, China and the European Union.

**What is the Cyber Military Club and What Does it Include?**

1. Offensive cyber capabilities.
2. Defensive cyber capabilities.
3. Cyber-defense industry.
4. Cyber infrastructure.

**What is the The Cyber Techno-Economy Club and What Does it Include?**

1. Access to information, accessibility to data.
2. AI industry.
3. Critical technologies (processing technologies).
4. Computing capabilities (super-computers, quantum computers).

**The "launch" point, who is able to lead to digital cyber security in the world and based on what?**

* The percentage of GDP invested in R&D - the distribution of investment between nations, relatively and absolutely. Israel invests some 60 billion shekels (2015 data). The USA and China are the superpowers with the largest scope of R&D budgets.
* VC as a percentage of GDP - here too, relative and absolute values will be examined. First the USA, then Israel, Canada and additional countries.
* On average, how much VC is invested in society.
* How many start-ups are there, in absolute terms, that were established in recent years.
* The productivity of the ICT industry is high in all countries.
* The scope of expenditures of business entities on R&D.
* How much of R&D expenditures come from foreign companies? In Israel it is very prominent. Most of the money originates from the business sector and from abroad. Israeli R&D is completely dependent on the business sector in Israel and abroad.

How did the software industry in Israel reach such high levels of investment and productivity? Was it due to government policy?

1. The industry was relevant to security, and in this manner it was built.
2. There was a global opportunity, and many turned to this field.
3. We "followed" the United States.

**The Israeli Approach to the Cyber Challenge:**

* Israel defined a holistic strategy for cyberspace, and it is approaching the techno-economic race.
* Israel has positioned itself as a cyber superpower for the first time in absolute terms, not just relative terms.
* Israel has global domination in the cyber field, and it is part of the race to attain digital cyber superiority. It also is yields political and security benefits.
* What is the benchmark and starting point of Israel in AI?
* Building a national plan that includes how Israel will become a superpower in this field:

1. What is critical for Israel? Israeli hi-tech must remain focused and successful in AI.
2. Where do we have a relative advantage?

And nothing else in between.

1. Based on the answers to the two previous questions, what is the national plan that we need?

* What technologies are required?

1. Computing capabilities.
2. Data sciences.
3. IOT and sensors.
4. Automatic and robotic systems (unmanned aircraft, drones, etc.).
5. Shared intelligence, e.g. "swarming".

A large part of the Israeli start-ups was based on ex-military personnel, and not due to government intent.

The recommendations of the 15 teams that dealt with the formation of policy in the field of AI.

1. **Infrastructures**
2. Very high computing, storage and communication capabilities. Including "threshold" capabilities in quantum computing, establishing a cloud in Israel.
3. Human capital - introducing data as a language in high schools.
4. Establishing research centers.
5. Opening the government and its repositories to companies.
6. **Accelerators**
7. Protecting technologies from cyber attacks.
8. Self-regulation and ethics, companies will do this, and by doing so will adhere to the high standards.
9. **The relative advantages**
10. Agricultural projects.
11. The field of medicine, changes in home hospitalization.
12. Developing the high-level performance capabilities for emergencies (connection to the Homefront Command).
13. Solving the transportation in Israel - smart traffic lights.
14. Digitization.
15. Promoting local industry.

The recommendation is to establish a directorate in the Prime Minister's office to manage the plan and the allocation 2 billion shekels per year for five years.

The national AI market is more than 30 trillion dollars. If Israel will invest in the field and will reach single-digit profits from this market, then Israel's economy will dramatically grow.

**Final Task:**

Write 1500-2000 words (8 pages) to discuss an issue where there is disagreement or tension between the official bodies.

For example: deterrence in cyber that that has not been adopted and includes tension.

Another example: strategic stability - does cyber power increase or decrease strategic stability.

The bibliography should include 3-4 sources. There should be quality analysis and your opinion should be expressed.

The assignment can be based on any test case.

Send Avi a short paragraph describing the topic for approval.

The paper can be written individually or in pairs.