تقرير الحلقة الرابعة

سمينار شباب الباحثين

"النـــمــذجــة الإحـــصــائـيـة"

إدارة الحلقة:

أ . محمد المغربي

المدرس المساعد بمركز التخطيط الاجتماعي والثقافي

المتحدثتان:

أ. ســالمة متــولي

المعيدة بمركز السياسات الاقتصادية الكلية

أ. بســنت مجــدي

المعيدة بمركز الأساليب التخطيطية

2019/1/22

عقدت الحلقة الرابعة من سيمينار شباب الباحثين ضمن الفاعليات العلمية لمعهد التخطيط القومي للعام الأكاديمي 2019/2018 يوم الثلاثاء الموافق 2019/1/22 بمقر المعهد – قاعة ا.د إبراهيم حلمي عبد الرحمن الدور السابع الساعة العاشرة صباحًا، بحضور عدد من أساتذة معهد التخطيط القومي وأعضاء الهيئة العلمية المعاونة. حيث تناول المتحدثتان وهم الأستاذة/ ســالمة متــولي – المعيدة بمركز السياسات الاقتصادية الكلية و الأستاذة/ بســنت مجــدي – المعيدة بمركز الأساليب التخطيطية موضوع النمذجة الإحصائية كما في العرض التقديمي المرفق.

وينقسم هذا التقرير إلى قسمين:

القسم الأول: المحتوى العلمي للحلقة والذى تم استعراضه من خلال المتحدثتان.

القسم الثاني: أهم المداخلات والمناقشات

القسم الأول: المحتوى العلمي للحلقة:

مقدمة

تأتي النمذجة من الكلمة اللاتينية Modellus للاختراق الحقيقي للنمذجة بدأ منذ العصر الحجري. كانت اول النماذج التي تم التعرف عليها الأرقام . ويعرف النموذج على أنه تمثيل وتبسيط للواقع , والنموذج يمكن ان يكن : رسم بياني – صورة – تجسيد مادي – معادلات رياضية – برنامج كمبيوتر ... إلخ.

الهدف من النموذج هو جعل الظواهر التي يتم تمثيلها سهلة في الفهم. وتستخدم النماذج في شرح وتفسير الظواهر والتنبؤ بالمستقبل واتخاذ القرارات وتوصيل معرفة .

معايير اختيار النموذج الجيد :

1. اختيار النموذج مهم
2. كل نموذج يمكن التعبير عنه بدرجات مختلفة من الدقة
3. أفضل النماذج التي تكون على اتصال مباشر بالواقع
4. نظرة واحدة او نموذج واحر غير كافي

النموذج الاحصائي هو المعادلة الرياضية المصاغة في شكل علاقات بين المتغيرات ويوضح كيفية ارتباط مجموعة من المتغيرات العشوائية بمجموعة أخرى من المتغيرات العشوائية.

يتم استخدام النموذج للتعبير عن العلاقة و يستخدم الاحصاء لتحديد مدى فائدة وموثوقية النموذج و لبناء النموذج هناك 4 خطوات رئيسية يجب اتباعها وهي:

1. جمع البيانات
2. استخدام الأساليب الوصفية
3. تحديد المتغيرات المفسرة
4. بناء النموذج وتفسير النتائج

تطورات النماذج الاحصائية:

بدأت النماذج الإحصائية بالتطبيق على النظريات الاقتصادية بما يعرف باسم الاقتصاد القياسي و الغرض الرئيسي منه اختبار الفرضيات والتنبؤ بالاتجاهات المالية ,وكان يتم استخدام تحليل الانحدار لتكوين علاقة بين المتغير التابع والمتغيرات المفسرة. ثم تم التطوير في النمذجة ليظهر ما تسمى المحاكاة وذلك بسبب المتطلبات التي يتطلبها النظام الاقتصادي من ردود افعال سريعة وزيادة متطلبات المستهلك واصبحت في تزايد وغير متوقعة وبالتالي اصبح استخدام تحليل الانحدار غير ملائم واصبح استخدام المحاكاة له العديد من المميزات ومنها توفير المال والوقت وأنه يعطى دقة أعلى من النماذج التقليدية و كذلك توفير بيئة خالية من المخاطر وفهم أكبر لطبيعة النظام. ثم تم التطوير في النماذج ليظهر ما يعرف باسم تحليل السلاسل الزمنية وذلك بعد ان كان علماء الاقتصاد القياسي يفترضوا عدم تأثير الوقت في شكل النموذج ,ولكن تم اثبات انه لا يجب نمذجة السلسلة الزمنية بالطرق العادية وتم الاتجاه إلى نمذجة السلسة الزمنية كدالة في قيمها السابقة ,ليظهر ما يعرف بنماذج ARMA – ARIMA واجبر علماء الاقتصاد القياسي بالتوجه إلى تحليل السلاسل الزمنية وتم تطوير نماذج .ARIMAX ثم تطورت النماذج الاحصائية نتيجة ظهور بعد المشاكل العالمية كظاهرة التغير المناخي التي تعتبر اكبر تهديد للبشرية ,والتغير المناخي هو تغير في التوزيع الاحصائي للمناخ وبالتالي كانت هناك الحاجة لنماذج تتنبأ بشكل عالمي وعلى المدى الطويل بحالة الجو والمناخ و من هنا ظهرت النماذج الشاملة أو العالمية. وقد أكدت النماذج الشاملة على فكرة الترابط

الكبير بين المتغيرات ,ما أدى لظهور ما يعرف بديناميات النظام , ويعتبر نماذج ديناميات النظام تغير كبير في مهوم النمذجة لأنه خرج من نطاق معادلات ليصل لمفهوم محاكاة حوسبية معتمدة على البيانات التي تعطى للبرنامج , ويتغير النموذج عبر الزمن بتغير البيانات التي يتم ادخالها.

وبذلك بدأت فكرة تداخل علم الحاسوب والاحصاء ليظهر الذكاء الاصطناعي و تعلم الألة و والتعلم العميق والذى تظهر حولنا الكثير من تطبيقاته منها ترجمة جوجل – وتطبيق SIRI و والسيارات ذاتية القيادة وغيرهم من التطبيقات والمبادرات. ومن هنا صعد مصطلح الثورة الصناعية الرابعة والذى كان أول من أطلقه كلاوس شواب المؤسس والرئيس التنفيذي لمنتدى الاقتصاد العالمي ومؤلف كتاب الثورة الصناعية الرابعة, ويمكن سهل مفهوم الثورة الصناعية الرابعة من خلال التكنولوجيات المختلفة حولنا من ذكاء اصطناعي و تطبيقات في التكنولوجيا الحيوية و العملات الرقمية و الطباعة ثلاثية الابعاد و غيرهم. الامر الذي يدفعنا ببقول بأننا امام عالم يعاد تشكيله و لا تصلح فيه النماذج التقليدية.

وفي هذا السياق يجب على المراكز البحثية مواكبة تلك التطورات بتطوير الابحاث سواء موضوعات او طرق تحليل وكذلك اجراء الفعاليات التي تلقي الضوء على الموضوعات الحية والتطبيقات والتطور في العلوم و التكنولوجيا، كذلك لا بد من تنمية الموارد البشرية بالمعهد بتوفير تدريبات وبرامج متعلقة بمناهج البحث الجديدة والبرامج التي تستخدم للتعامل مع الكم الهائل من البيانات وتوفير نتائج وتنبؤ أفضل.

وكان هذا ملخصا باللغة العربية للمادة العلمية التي تقدم بها الباحثتان باللغة الانجليزية، حيث النص الكامل كما يلي:

The history of modeling

The word “modeling” comes from the Latin word **modellus**. It describes a typical human way of coping with the reality.

The abstract representations of real-world objects have been in use since the stone age, a fact backed up by cavemen paintings, the real breakthrough of modeling came with the cultures of the Ancient Near East and with the Ancient Greek.

The first recognizable models were numbers; counting and “writing” numbers (marks on bones) is documented since about 30.000 BC. Astronomy and Architecture were the next areas where models played a role, already about 4.000 BC. It is well known that by 2.000 BC at least three cultures (Babylon, Egypt, India) had a decent knowledge of mathematics and used mathematical models to improve their every-day life.

What is a model?

Object modeling is a **technique** for identifying objects within the systems environment and the relationships between those objects. Modeling is a **process** that uses math to represent, analyze, make predictions, or otherwise provide insight into real-world phenomena.

Modeling is the process of identifying a suitable model

A model is a **simplification** of reality.

In science, a model is a **representation** of an idea, an object or even a process or a system that is used to describe and explain phenomena that cannot be experienced directly. Models are central to what scientists do, both in their research as well as when communicating their explanations.

A scientific model is a representation of a particular phenomenon in the world using something else to represent it, making it easier to understand. A scientific model could be a **diagram** or **picture**, **a physical** model like an aircraft model kit you got when you were young, **a computer program, or set of complex mathematics** that describes a situation. Whatever it is, **the goal** is to make the particular thing you're modeling easier to understand. When we do that, we're able to use it to predict what will happen in the future. For example, predicting what will happen as our climate changes would be easy if we could make a fully accurate model of the atmosphere.

All models are wrong

George box said that “all models are wrong", "All models are wrong but some are useful".

The comments on his aphorism:

It does not seem helpful just to say that all models are wrong. The word model implies simplification and idealization. The idea that complex physical, biological or sociological systems can be exactly described by a few formulae is patently absurd. The construction of idealized representations that capture important stable aspects of such systems is, however, a vital part of general scientific analysis and statistical models, especially substantive ones, do not seem essentially different from other kinds of model.

A model is a simplification or approximation of reality and hence will not reflect all of reality. ... Box noted that "all models are wrong, but some are useful." While a model can never be "truth," a model might be ranked from very useful, to useful, to somewhat useful to, finally, essentially useless.

The statistician David Hand made the following statement in 2014.

In general, when building statistical models, we must not forget that the aim is to understand something about the real world. Or predict, choose an action, make a decision, summarize evidence, and so on, but always about the real world, not an abstract mathematical world: our models are not the reality—a point well made by George Box "all models are wrong, but some are useful".

Although the aphorism seems to have originated with George Box, the underlying idea goes back decades, perhaps centuries. For example, in 1960, Georg Rasch said the following.

… no models are [true]—not even the Newtonian laws. When you construct a model you leave out all the details which you, with the knowledge at your disposal, consider inessential…. Models should not be true, but it is important that they are **applicable**, and whether they are applicable for any given purpose must of course be investigated. This also means that a model is never accepted finally, only on trial.

Similarly, in 1947, John von Neumann said that "truth … is much too complicated to allow anything but approximations".

What is modeling for?

Imagine wanting to study a big problem in the world. Maybe you're thinking of finding the cure for cancer, developing next year's flu vaccine, or even predicting the weather more reliably. The scientists, know the way to solve their problems is through conducting scientific investigations where they propose a prediction based on past data, test one variable at a time, collect, and finally analyze their data.

But what do you do if the system in question is too big to test? We can't just experiment on every person with cancer, or control aspects of the weather during an investigation. So how are scientists supposed to figure out these mysteries if they can't conduct classic investigations? They get around this problem by constructing models. Models are representations of real scientific phenomenon that may be difficult to study in the real world. Models may be physical representations, diagrams, theories, or mathematical equations.

Although models vary in their structure, they serve common purposes for scientists. Sometimes models help scientists visualize something, such as the Bohr model of atomic structure. Other times, models are designed to analyze past data and make predictions about the future, such as models of seismic activity to predict future earthquakes. Some other models are designed to **recreate a problem**, such as an animal model of human disease, so scientists can test possible treatments. **Mainly we can use modeling for:**

Explain Phenomena. Most of the theories developed in physics belong to this category: Newton' s mechanics, thermodynamics, Einstein' s theory of relativity, quantum mechanics, the Standard Model of particle physics, and many more. There is not only physics, however. The aggregate demand-price adjustment (AD-P A) model, the aggregate demand-inflation adjustment (ADIA) model, or the Hicks-Hansen IS/LM Model are three examples of economic models describing macro economical equilibria.

Make Predictions. After the models are built which explain the phenomena, these models can be used as a further step to make predictions about the future development of a real-world phenomenon. The avalanche researchers, for example, take their state data and the topographical information of the slopes to make predictions on the probability that avalanches are triggered, on their likely strengths and their presumed places.

Decision Making. A car driver uses a model of his surroundings and the typical traffic on the streets to decide which route to take. Of course, this model of the real world, reduced to streets and average traffic, is in no way a formal mathematical one.

Communication. Another important aspect of models is that they can be used to communicate knowledge. If a person A wants to visit person B, he might ask for the way to drive. B will sketch the correct route on a sheet of paper with a few lines and some additional marks and text, like "here at the corner is a yellow house with small garden". This sheet of paper is a visual model for the surroundings of B' s house; its purpose is to communicate a subset of B' s knowledge about his city to A.

Principles of modeling

four basic principles of modeling.

1.The choice of what models to create has a profound influence on how a problem is attacked and how a solution is shaped.

In other words, choose your models well. The right models will brilliantly illuminate the most wicked development problems, offering insight that you simply could not gain otherwise; the wrong models will mislead you, causing you to focus on irrelevant issues.

2. Every model may be expressed at different levels of precision.

Sometimes a quick and simple executable model of the user interface is exactly what you need; at other times you have to get down and dirty with the bits, such as when you are specifying cross-system interfaces or wrestling with networking bottlenecks. In any case, the best kinds of models are those that let you choose your degree of detail, depending on who is doing the viewing and why they need to view it. An analyst or an end user will want to focus on issues of what; a developer will want to focus on issues of how. Both of these stakeholders will want to visualize a system at different levels of detail at different times.

3. The best models are connected to reality.

A physical model of a building that doesn't respond in the same way as do real materials has only limited value; a mathematical model of an aircraft that assumes only ideal conditions and perfect manufacturing can mask some potentially fatal characteristics of the real aircraft. It's best to have models that have a clear connection to reality, and where that connection is weak, to know exactly how those models are divorced from the real world. All models simplify reality; the trick is to be sure that your simplifications don't mask any important details.

4.No single model or view is sufficient. Every nontrivial system is best approached through a small set of nearly independent models with multiple viewpoints.

If you are constructing a building, there is no single set of blueprints that reveal all its details. At the very least, you'll need floor plans, elevations, electrical plans, heating plans, and plumbing plans. And within any kind of model, you need multiple views to capture the breadth of the system, such as blueprints of different floors.

Statistical model

Statistics is an important and a very special branch of mathematics. It is concerned about the gathering, organizing, observing, calculating, analyzing, interpreting and forecasting numerical (usually large) data.

Statistics involves various different formulae that are useful in performing statistical researches and surveys. There are different types of variables used in statistics. At times, it is required to find the relationships among the variables of a research.

It is also needed that that these relations are expressed in the form of equations. These mathematical equations used in statistical processes are known as statistical models. These models describe the connection between two or more variables and also do formulate the relation. In this article, we are going to learn about the statistical models, their various types and their applications.

The statistical model may be defined as the mathematical equation that are formulated in the form of relationships between variables. A statistical model illustrates how a set of random variables is related to another set of random variables.

A statistical model is a simplified, mathematically-formalized way to **approximate** reality (i.e. what generates your data) and optionally to make predictions from this approximation. The statistical model is the mathematical equation that is used.

We use modeling to explore a relationship. We use statistics to determine how useful and reliable our model is. We build a model so that we can better understand the system we developing. Example. Suppose you want to report the weight of a variety of potatoes. We will consider a hard and an easy way to do it.

The hard way is spending years measuring the weight of every single potato of this variety in the world, and reporting your data in an endless Excel spreadsheet.

The easy way is selecting a 30 potato-wide representative sample of this variety, computing its average and standard deviation and reporting only those two numbers as an approximate description of this weight. Representing a quantity by an average and a standard deviation is a very simple form of statistical modeling.

Types

There are different types of statistical models used in various statistical processes. The statistical models are classified on the basis of number and types of variables and equations used in the process. These models can be broadly categorized as:

1) The complete models

2) The incomplete models

complete model does have the number of variables equal to the number of equations; while an incomplete model does not have number of variables same as number of equations.

How to Build a Statistical Models?

In order to build a statistical model, one needs to remember the following points:

1) **Data Gathering**: Data should be collected from a proper and authoritative source so that the uncertainty is to be reduced from the information about something on interest.

2) **Descriptive Methods:** The descriptive methods and graphs are to be utilized in order to summarize the factual of the data we have.

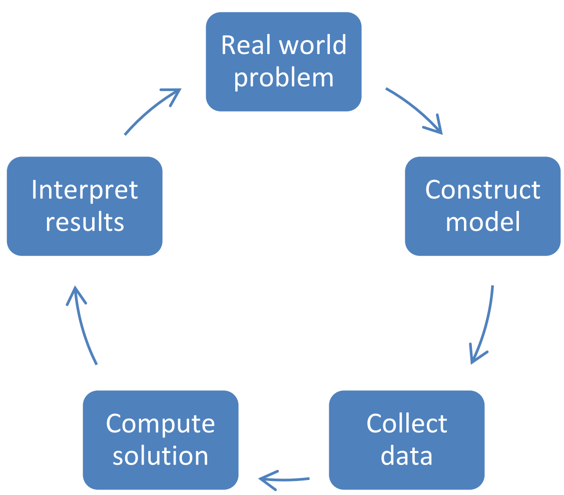
3) **Thinking about Predictors:** The predictors and the variables are required to be thought and imagined about a model. For an example of model of socio-economic status of a person, the potential sets of predictors and variables may include - the demographics such as age, sex economic status, mental health i.e. any diagnoses of mental illness or history of alcoholism, psychological health such as stress or depression, the social condition like - isolation, number of friends, connection with the family.

By creating each set separately, one is able to build theoretically meaningful models.

4) **Building of model and Interpreting the Results**

A statistical model should be such an expressive one that it tells us a story. Emphasis at the coefficients; have a look at the relationships between coefficients and control variables. It should be quite easier to interpret and forecast the result by having just a look at the model.

The modeling process



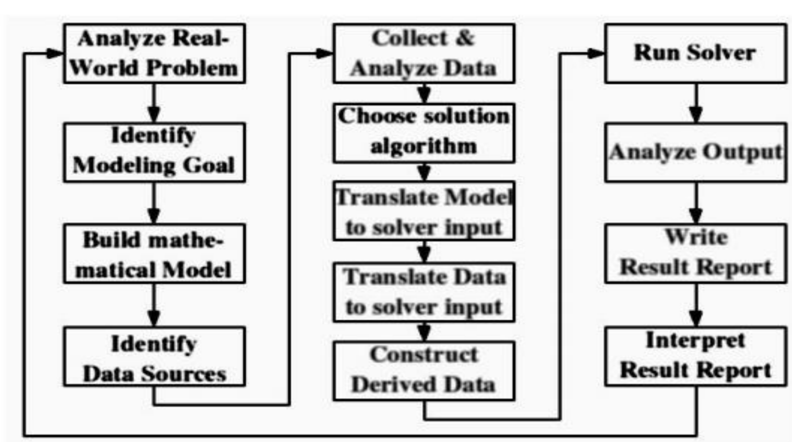


Figure 2.4.3. Detailed modeling cycle

Development of Statistical Models:

1) Econometrics:

Econometrics is the analysis and testing of economic theories to verify hypotheses and improve prediction of financial trends. Econometrics takes mathematical and statistical models proposed in economic theory and tests them.

Econometrics uses an important statistical method called regression analysis, which assesses the connection among variables. Economists use the regression method since they cannot usually carry out controlled experiments, choosing to instead gather information from natural experiments.

A simple example of an econometric model is one that assumes that monthly spending by consumers is linearly dependent on consumers' income in the previous month. Then the model will consist of the equation

$$C_t = a + b\, y_{t-1} + e_t$$

2) Simulation:

Nowadays, the economy requires a fast and flexible reaction to the market. Customer demands become more and more dynamic and unpredictable. It is hard to tell how logistics system reacts to future changes. We might want to know what the best solution is for now, but also for the future. This is hard to predict with static calculations, because systems have a lot of dependences, that are not static. The only tool that can analyze and improve these complex and dynamic systems, is simulation.

Advantages of simulation models:

a) risk-free environment

Simulation modeling provides a safe way to test and explore different “what-if” scenarios. The effect of changing staffing levels in a plant may be seen without putting production at risk. Make the right decision before making real-world changes.

b) save money and time

Virtual experiments with simulation models are less expensive and take less time than experiments with real assets. Marketing campaigns can be tested without alerting the competition or unnecessarily spending money.

c) Visualization

Simulation models can be animated in 2D/3D, allowing concepts and ideas to be more easily verified, communicated, and understood. Analysts and engineers gain trust in a model by seeing it in action and can clearly demonstrate findings to management.

d) Insight into dynamics

Unlike spreadsheet- or solver-based analytics, simulation modeling allows the observation of system behavior over time, at any level of detail. For example, checking warehouse storage space utilization on any given date.

e) increased accuracy

A simulation model can capture many more details than an analytical model, providing increased accuracy and more precise forecasting. Mining companies can significantly cut costs by optimizing asset usage and knowing their future equipment needs.

f) handle uncertainty

Uncertainty in operation times and outcome can be easily represented in simulation models, allowing risk quantification, and for more robust solutions to be found. In logistics, a realistic picture can be produced using simulation, including unpredictable data, such as shipment lead times.

3) Time Series:

Before 1970, econometricians and time series analysts used vastly different methods to model a time series. Econometricians modeled time series are a standard linear regression with explanatory variables suggested by economic theory/intuition to explain the movements in time series data. They assumed that the time series being ‘nonstationary’ (growing overtime) had no effect on their empirical analysis. Time series analysts on the other hand ignored this traditional econometric analysis. They modeled a time series as a function of its past values.

They worked around the problem of non-stationarity by differencing the data to make it stationary. Econometricians were forced to pay attention to the methods of time series analysts, the most famous of which was the Box–Jenkins approach. Box and Jenkins claimed (successfully) that nonstationary data can be made stationary by differencing the series.

Econometricians ignored the Box-Jenkins approach at first but were forced to pay attention to them when it *ARIMA* forecasts started consistently outperforming forecasts based on standard econometric modelling. The lack of sound economic theory behind the *ARIMA* was troubling for econometricians to accept. They responded by developing another class of models that incorporated autoregressive and moving average components of Box-Jenkins approach with the 'explanatory variables' approach of standard econometrics. The simplest of such models is the *ARIMAX* which is just an *ARIMA* with additional explanatory variables provided by economic theory.

4) System Dynamics

Dynamic models are generally models that contain or depend upon an element of time, especially allowing for interactions between variables over time. A separate idea with the same name is models that are updated over time with new data. System dynamics is an approach to understand the behavior of systems. These systems are all around us; they are sets of interrelated objects or entities that interact with each other. They can be living beings, such as humans, animals, and plants. They can be mechanical entities, such as automobiles, ships, and airplanes; or industrial plants, such as oil refineries, chemical plants, and electric power generators. There are also other entities, such as social, political, and business systems. The behaviors of these systems are shaped by their environments, by the actions and interactions of their sub entities, and by human beings. However, it is interesting to note that all these disparate systems exhibit some common behavior patterns.

System dynamics is a computer simulation modeling methodology that is used to analyze complex nonlinear dynamic feedback systems for the purposes of generating insight and designing policies that will improve system performance. It was originally created in 1957 by Jay W. Forrester of the Massachusetts Institute of Technology as a method for building computer simulation models of problematic behavior within corporations. The models were used to design and test policies aimed at altering a corporation's structure so that its behavior would improve and become more robust. Today, system dynamics is applied to a large variety of problems in a multitude of academic disciplines, including economics.

5) Machine learning

Machine learning (ML) is a category of algorithm that allows software applications to become more accurate in predicting outcomes without being explicitly programmed. The basic premise of machine learning is to build algorithms that can receive input data and use statistical analysis to predict an output while updating outputs as new data becomes available.

The processes involved in machine learning are similar to that of data mining and predictive modeling. Both require searching through data to look for patterns and adjusting program actions accordingly. Many people are familiar with machine learning from shopping on the internet and being served ads related to their purchase.

Drawbacks of the Machine Learning

1. Traditional ML algorithms are not useful while working with high dimensional data, that is where we have a large number of inputs and outputs. For example, in case of handwriting recognition we have large amount of input where we will have different type of inputs associated with different type of handwriting.
2. Second major challenge is to tell the computer what are the features it should look for that will play an important role in predicting the outcome as well as to achieve better accuracy while doing so. This very process is referred as feature extraction.

6) Deep Learning (Neural Networks)

Deep learning is one of the only methods by which we can overcome the challenges of feature extraction. This is because deep learning models are capable of learning to focus on the right features by themselves, requiring little guidance from the programmer. Basically, deep learning mimics the way our brain functions i.e. it learns from experience. As you know, our brain is made up of billions of neurons that allows us to do amazing things. Therefore, we can say that Deep Learning is a subfield of machine learning concerned with algorithms inspired by the structure and function of the brain called artificial neural networks.

Applications of Deep Learning:

1. Speech Recognition (Siri)
2. Automatic Machine Translation (Google translation)
3. Instant Visual Translation
4. Automated Self Driven Cars (WAYMO)

Fourth Industrial Revolution "Industry 4."

The person who labeled today's advances as a new revolution was Klaus Schwab, Founder and Executive Chairman of the World Economic Forum and author of a book titled The Fourth Industrial Revolution. In a 2016 article, Schwab wrote that "like the revolutions that preceded it, the Fourth Industrial Revolution has the potential to raise global income levels and improve the quality of life for populations around the world."

The easiest way to understand the Fourth Industrial Revolution is to focus on the technologies driving it. These include the following:

- Artificial intelligence (AI) describes computers that can "think" like humans — recognizing complex patterns, processing information, drawing conclusions, and making recommendations.
- Blockchain is a secure, decentralized, and transparent way of recording and sharing data, with no need to rely on third-party intermediaries. The digital currency Bitcoin is the best known blockchain application.
- New computational technologies are making computers smarter. They enable computers to process vast amounts of data faster than ever before, while the advent of the "cloud" has allowed businesses to safely store and access their information from anywhere with internet access, at any time. Quantum computing technologies now in development will eventually make computers millions of times more powerful. These computers will have the potential to supercharge AI, create highly complex data models in seconds, and speed up the discovery of new materials.

- Virtual reality (VR) offers immersive digital experiences (using a VR headset) that simulate the real world, while augmented reality merges the digital and physical worlds. Examples include L'Oréal's makeup app, which allows users to digitally experiment with makeup products before buying them, and the Google Translate phone app, which allows users to scan and instantly translate street signs, menus, and other text.
- Biotechnology harnesses cellular and biomolecular processes to develop new technologies and products for a range of uses, including developing new pharmaceuticals and materials, more efficient industrial manufacturing processes, and cleaner, more efficient energy sources.
- Robotics refers to the design, manufacture, and use of robots for personal and commercial use.
- 3D printing allows manufacturing businesses to print their own parts, with less tooling, at a lower cost, and faster than via traditional processes.
- The IoT describes the idea of everyday items — from medical wearables that monitor users' physical condition to cars and tracking devices inserted into parcels — being connected to the internet and identifiable by other devices.

The role of INP:

Research projects of INP have to keep pace with software and modelling development to optimize the results and predictions of these projects.

Increase the knowledge and skills of human resources in INP by providing trainings and courses related to new research methodologies, current issues as big data and new technologies, and software development.

القسم الثاني: أهم المداخلات والمناقشات

اتسمت مداخلات السادة الحضور بالتنوع بين الأسئلة والاستفسارات اضافة الى بعض التعليقات التطويرية حيث يمكن عرضها بإيجاز في النقاط التالية:

- ضرورة التركيز علي التدقيق والتنقيح في استخدام المصطلحات العلمية المختلفة وكذلك البعد عن المترادفات المتعددة والمترجمة.
- التأكيد على أن النموذج ليس بالضرورة معادلة ولكن يمكن أن يوضح علاقة بين متغيرين، أو تصوير لظاهرة او نظام او مشكلة، ويأخذ في الاعتبار جميع المتغيرات والأبعاد السياسية والاقتصادية والاجتماعية وغيرها، والعلاقات بين هذه المتغيرات وخصائص تطورها. حيث ان الهدف من بناء اي نموذج يكمن في :
  - إما اكتساب معارف جديدة،
  - أو الوصول الي صورة مثلي في ظل الظروف المحيطة الواقعية القائمة،
  - أو تنبؤ لصورة مستقبلية.
- مراعاة الفرق بين النموذج الرياضي والنموذج الإحصائي؛ حيث يتطلب النموذج الإحصائي الإلمام بالموضوع او المشكلة والظروف المحيطة بشكل أكثر تعقيدا.
- ان موضوع النمذجة الاحصائية وتطبيقاتها المتعددة والمتشعبة يلفت الانتباه إلى التأكيد علي أهمية تعليم الرياضيات والعلوم في مصر وتطبيقاتها، والتي تشهد تراجعاً يلمسه الأساتذة في قاعات الدراسة والبحث في صورة قصور واضح لدى الأجيال الناشئة في أسس الرياضيات والعلوم.
- تعد تقنية المحاكاة من التقنيات الأساسية في عملية التعليم والتدريب في مجال الطيران، حيث تعرض المتدرب لظروف مختلفة وتدربه علي كيفية مواكبة ظروف غير طبيعية مثل الحوادث والتغيرات المتوقعة.
- تظل قضية صلاحية النماذج Validation وسبل تطبيقها علي أرض الواقع من أهم القضايا التي تواجه الإحصائيين مع المتخصصين في جميع المجالات؛ ويدعم ذلك فكرة التركيز علي التكامل بين الإحصاء والاقتصاد أو بين الإحصاء والاجتماع وغيرها من التخصصات المختلفة

وكذلك الاستفادة من تكامل التخصصات وتفعيل مبادئ العمل البحثي الجماعي العابر للتخصصات، ودعم الترابط بينها من خلال نظم المعلومات المستحدثة.

- ان التطبيق الجيد لمعطيات النمذجة الاحصائية والاستفادة منها يواجه بصعوبات، حيث لايزال العائق الأساسي لعمل النماذج أو الأبحاث في مصر هو قصور المعلومات والبيانات وإتاحتها ومدي صحتها؛ فإن الاستثمار في البيانات هو بمثابة استثمار في المستقبل.
- من المفيد للباحثين الإلمام بتاريخ المبادرات الدولية التي اهتمت بتوظيف النماذج الإحصائية في الشأن التنموي الدولي والتي لعبت فيها مصر دوراً بارزاً من خلال معهد التخطيط القومي ومنها على سبيل المثال نادى روما للتنمية Club of Rome، ومن ثم توظيف هذا الإرث العلمي المتميز في الإبحار نحو المستقبل.

<u>وجدير بالذكر</u> تفضل أحد السادة الحضور من خارج المعهد بالتقدم باقتراح وتوصية لإدارة المعهد بشأن انشاء حاضنة بحثية تطبيقية في مجال النمذجة، بحيث تمثل نقطة تلاقي بين المجتمع الأكاديمي والبحثي من جهة والجانب التطبيقي العملي في مجتمع الصناعة والأعمال من جهة أخري، مما سيعود بالنفع والفائدة على كلا الجانبين مضافا اليه النفع العام في مسيرة التنمية الشاملة لمصرنا الغالية.