Artificial Intelligence and Analytics for IT in Organizations Course (AI & Analytics for ITO)

Objective:

- To acquire a foundational understanding of Machine Learning (ML) principles.
- To gain proficiency in low-code/no-code Machine Learning and Analytics Tools, including Digital Analytics and Data Analytics.

Learning Outcomes

- Comprehend fundamental ML concepts.
- Develop the ability to apply machine learning using low-code/no-code tools like Teachable Machine.
- Acquire the skill to conduct digital analytics through a cloud-based Google Analytics platform.
- Understand user behavior and app usage patterns to assess the effectiveness of business and marketing objectives.
- Develop data analytics capabilities, including dashboard design for data visualization and informed decision-making.

Prepared by: - Workneh Y. Ayele, October 2024

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1 Machine Learning

Machine Learning is when a computer learns to do something without being explicitly programmed. This means we submit many examples to the computer so that it knows them instead of giving rules. Once the computer learns, it makes predictions and figures out patterns based on what it has learned. In a nutshell, there are two types of machine learning: supervised and unsupervised.

1.1 Supervised Machine Learning

Supervised machine learning refers to the process where computers are trained on input data that includes corresponding correct outputs, also known as labeled data. By analyzing these examples, the system learns to make accurate predictions or classifications. This concept is similar to how children learn using flashcards: they are shown images paired with labels, and through repetition, they recognize and correctly identify the items when encountered later.

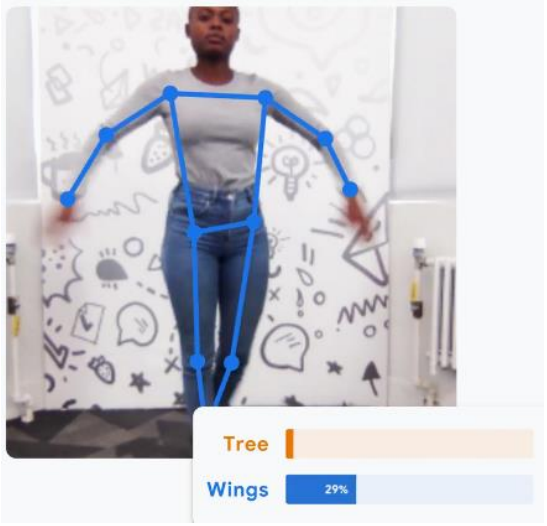
1.2 Unsupervised Machine Learning

Unsupervised machine learning involves training computers using input data without any labeled outputs. The computer is tasked with independently identifying patterns, structures, or relationships within the data without prior knowledge. This is similar to a child exploring a set of toys without being told what the toys are; the child must independently group similar toys or recognize underlying patterns based on their observations.

2 Teachable Machine (Cloud-based Low-code/Zero-code Tool)

Teachable Machine is a free, cloud-based, user-friendly tool provided by Google that makes it fast and easy to create machine learning models without requiring coding. Teachable Machine enables you to develop machine learning models that identify images, detect different poses you make, and recognize sounds without writing codes. Also, Teachable Machine allows you to export your trained models for use in your apps, websites, or projects. Furthermore, Teachable Machine enables you to export your codes for mobile apps for Node.js projects, such as JavaScript and Python. You can choose from three types of projects: Image Project, Audio Project, and Pose Project.

- **Image Project** – A Teachable Machine image project creates AI models based on images from files or your webcam. The image project is particularly tailored to develop AI applications for object detection and image classification.
- **Audio Project** – A Teachable Machine audio project creates AI models based on one-second-long sounds from files or your microphone. The audio project is particularly tailored to develop AI applications to recognize and classify different audio sounds, such as speech recognition.
- **Pose Project** – A teachable Machine *pose project* is used to create AI models based on images from files or webcams. The image project is particularly tailored for developing AI applications to recognize and estimate poses from pictures or videos.



Real-world examples of projects you can create using Teachable Machine are presented below:

2.1 Application Image Recognition Using TM

- Sales Organizations
    - Apps designed to assist visually impaired people for in enabling shopping by enabling detecting/sorting shopping items.

- Waste management
    - Waste sorting using image classification, also known as intelligent recycling bins, enables the classification of types of waste into plastic, paper, metal, glass, etc., using the camera as an input device.

- Healthcare and agriculture
    - In healthcare, ML can be used to detect skin conditions such as acne and moles in telemedicine applications. Similarly, ML can be used to analyze x-ray images and detect defects such as fractures.
    - In agriculture, disease detection, for example, if you try the machine with perfect plant textures and those infected with bacteria or fungus, it can be easily detected. This can be used to detect rotten fruits and those that are perfect for the market.

- Education
    - Develop applications recognizing objects, including intangible objects such as written alphabets and numbers.
    - Help students with disabilities communicate using gestures, sounds, and images
- Inventory systems and warehouses
    - Detect and categorize different items for counting items on the shelf and so on.

2.2 Application Sound Classifier Using TM

- Babies and children monitoring apps
    - apps alert when babies cry, alert care takes when children fall while playing.
- Elderly care and home care
    - Monitor elderly people to detect dangerous and life-threatening situation.

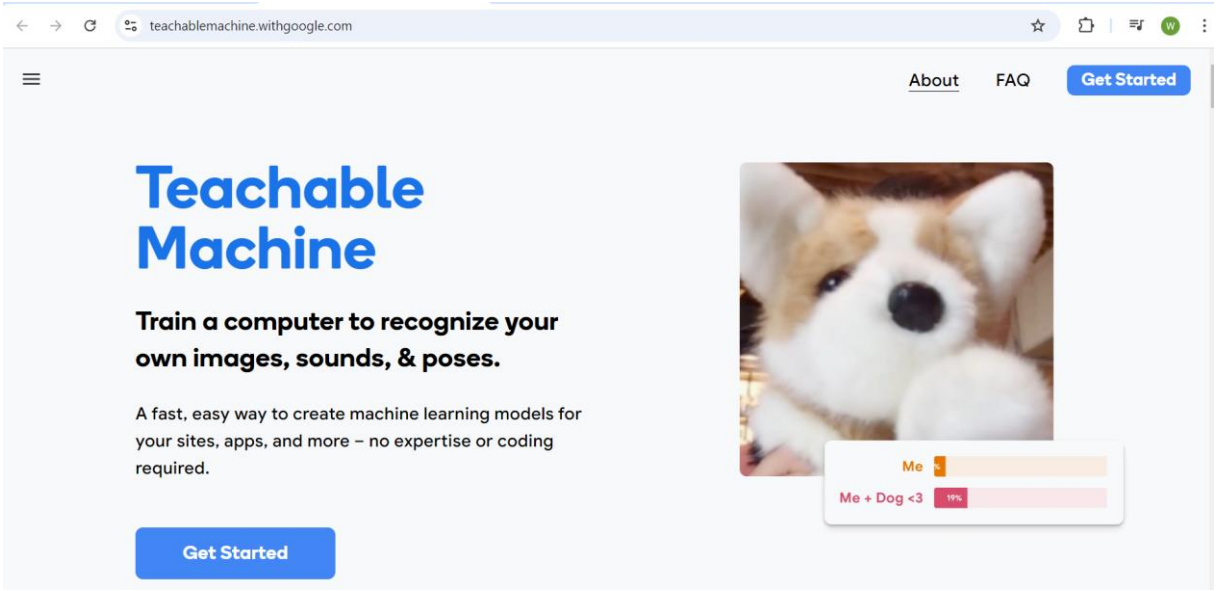
2.3 Application Pose Detection Using TM

- Sporting
    - Virtual fitness coach – apps that gives you feedback to get training.
    - Yoga pose training tool – apps enable students to learn yoga poses and fix their pose alignment.
- Music
    - Teach dancing moves
    - Give feedback about dancing moves
- Physical therapy
    - Apps helping patients perform exercises to help patients recover

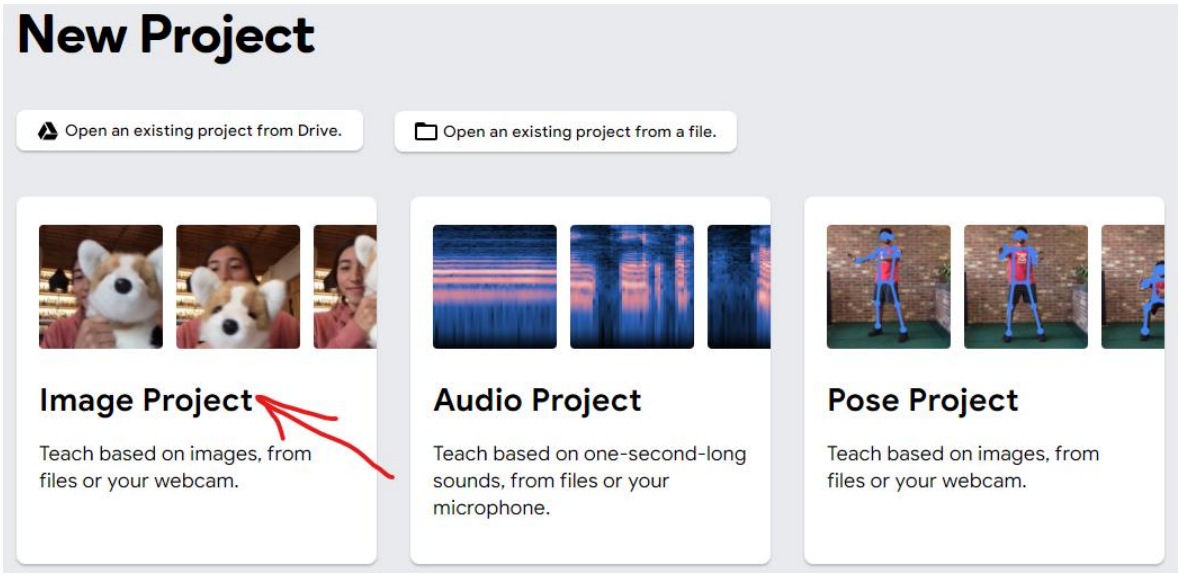
2.4 Sep-by Step Guide to Using Teachable Machine

2.4.1 Creating an Image Project by using your webcam:

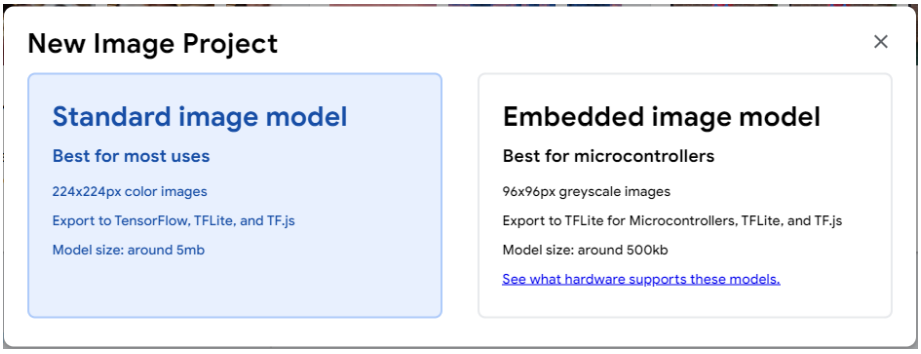
- Open the Teachable Machine website on your browser - https://teachablemachine.withgoogle.com/



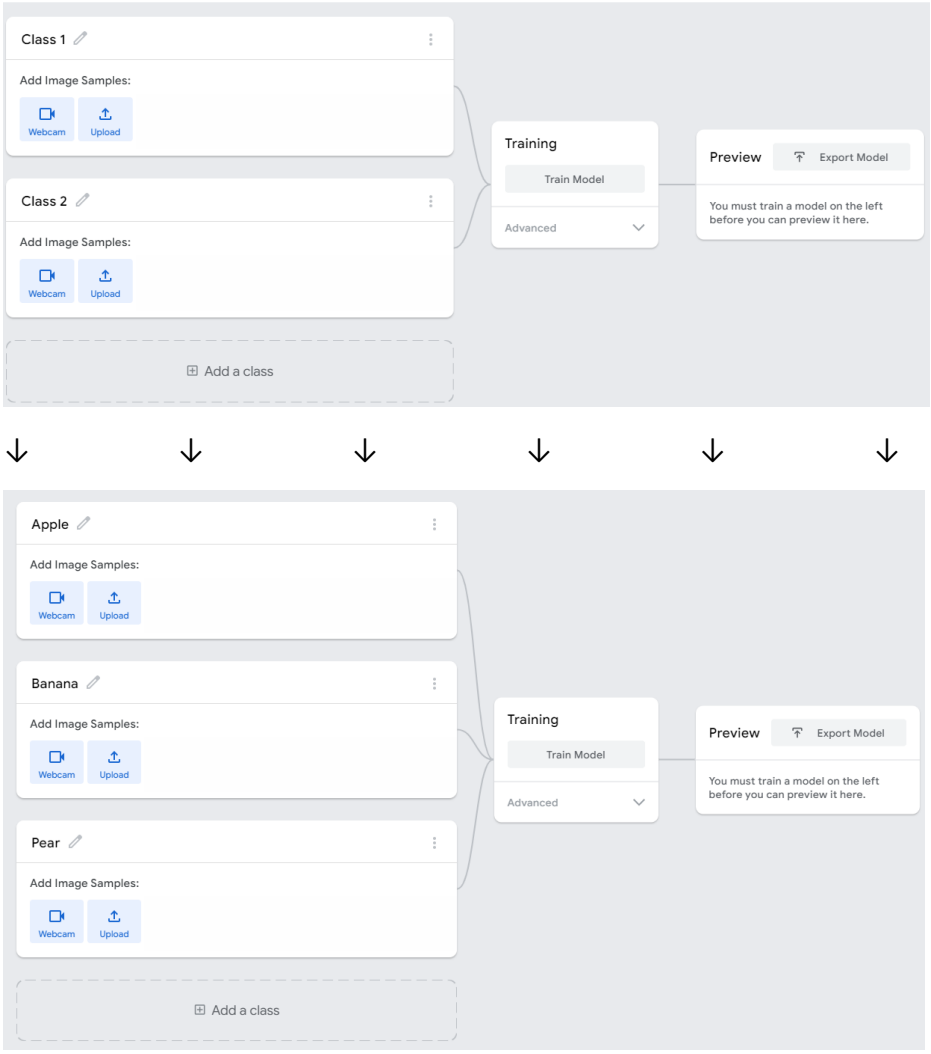
- Click on **Get Started**
- Click on **Image Project**



- Select **the Standard image model** on the New Image Project from the dialog



- Rename Class 1 to Apple, Class 2 to Banana,
- Click on **Add a Class** and rename Class 3 to Pear

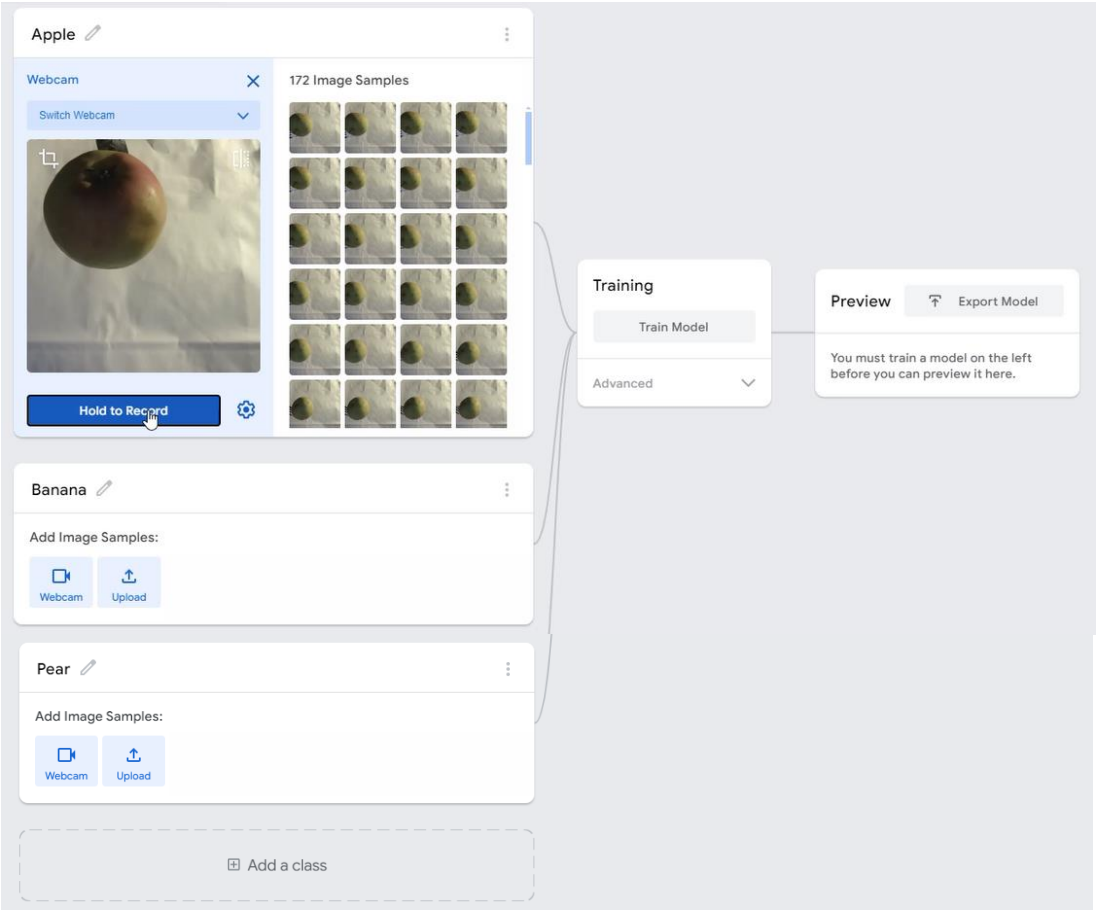


2.4.2 Use your webcam or Upload images to create sample images

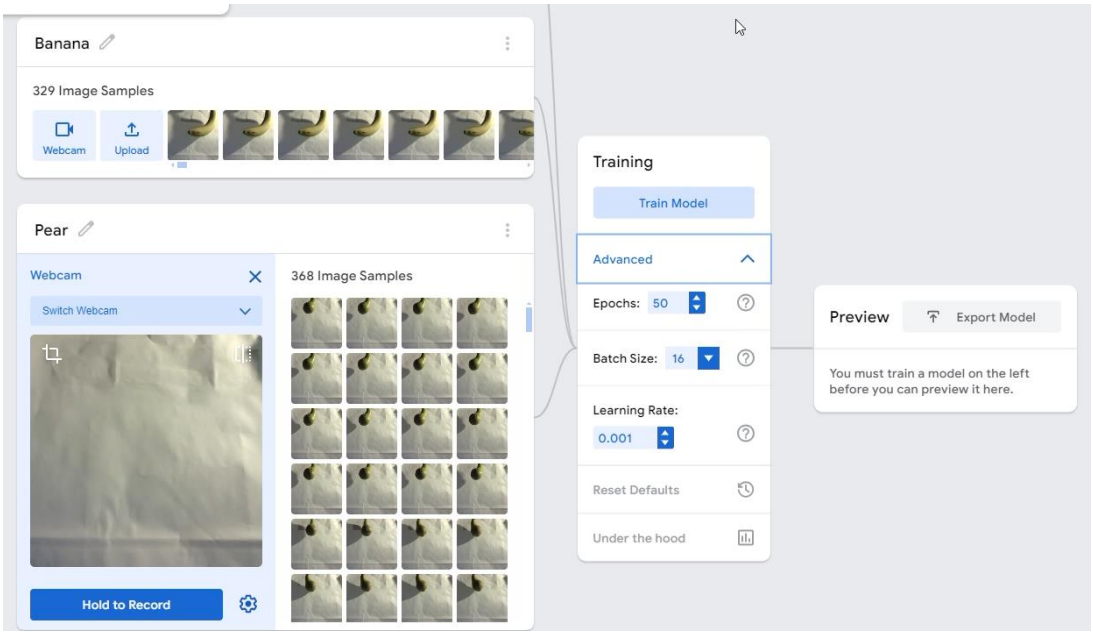
It will help you if you have an apple, a banana, and a pear. Do not worry! If you do not have those fruits, you will upload pictures of the fruits that are available online or captured by your mobile device or cameras. You can download images from the GitHub repository, with 5125 natural images from 81 different classes - https://github.com/marcusklasson/GroceryStoreDataset.

2.4.2.1 Taking Samples Using Webcam

- Click on **Webcam** under Apple class.
- Position the apple to take samples using the webcam.
- Click and hold the **Hold to Record** button while changing the orientation of the fruit, and include other fruits with a slightly different size and texture.

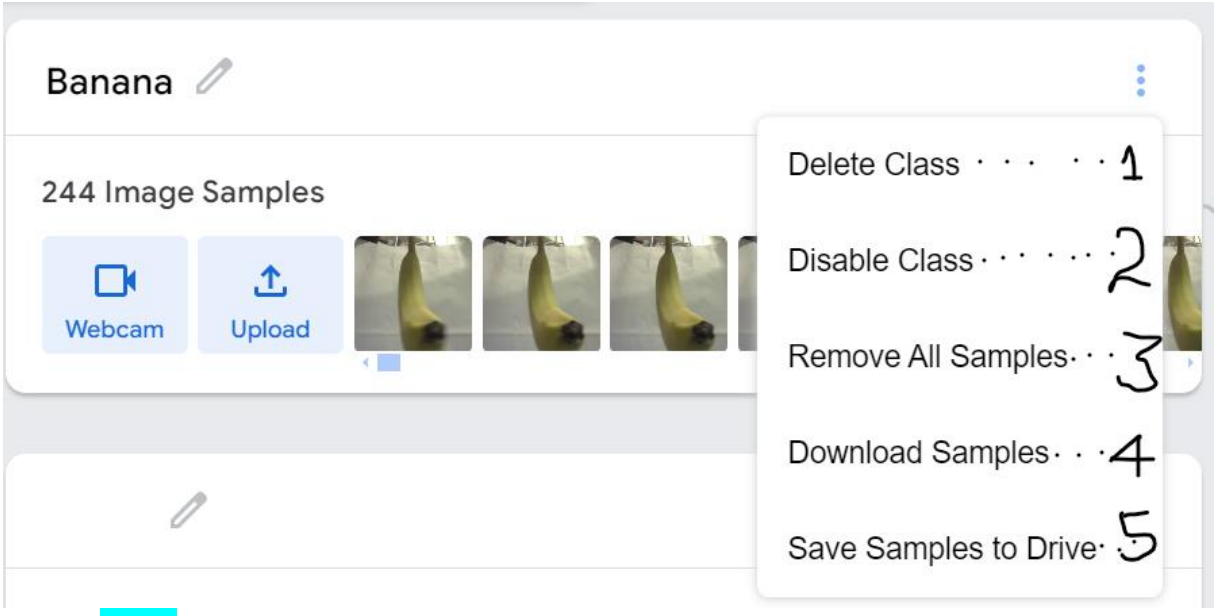


- Use your **Webcam** to take samples of **Bananas** and **Pears** as you did before.



2.4.2.2 *Deleting Image Sample (Image Samples from the Banana class)*

- Click on the ellipsis (the three vertically aligned dots on the corner of the class that you want the sample images to replace).
- Select **Remove All Samples** (3), which is used to remove the sample from your current class.

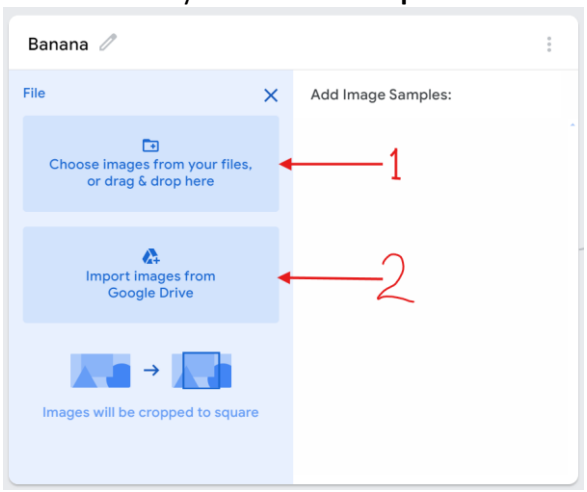


Note

(1) **Delete Class (1)** Delete Class is used to delete the Class with its samples
(2) **Disable Class (2) -**Disable Class is used to disable the Class thus, it will not be used for the training
(3) **Remove All Samples (3)** - Remove All Samples is used to remove the samples you added before. This does not delete the Class.
(4) **Download Samples (4)** – you can use this option to download the samples to your computer.
(5) **Save Samples to Drive (5)** – you can use this option to save the samples to your Google Drive.

2.4.2.3 *Upload Sample Images from your devices*

- Under your class select **Upload**

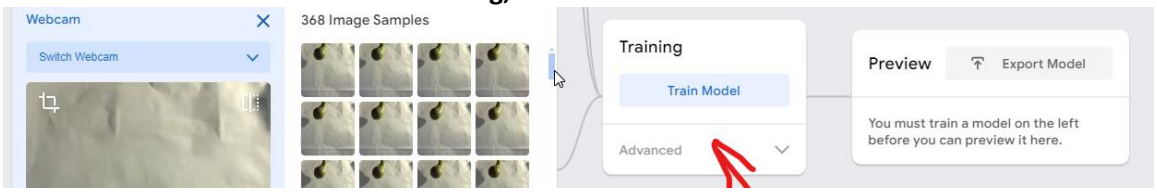


- You have two options: get the image samples from your computer's local drives **(1)** or your Google Drive **(2)**.

- You have three options if you want to upload images from your computer. The first option is to click on **Choose images from your files or drag & drop here**. The second option is to drag and drop the image(s) by dragging the pictures and dropping them on "**Choose images from your files or drag & drop here**." The third option is to upload the image files by locating the files and uploading them
- **(2) Import images from Google Drive** – you can upload images if they are stored in Google Dive.

2.4.2.4 Train your model (Training)

- Click on **Advanced** under **Training,** as illustrated below.

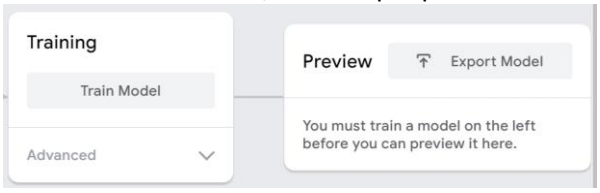


- Use default settings for Epochs, Batch Size, and Learning Rate, which means leaving the default values if you have changed the values of Epochs, Batch Size, and Learning Rate. You can reset to the default value by clicking on **Reset Defaults**, then Teachable Machine sets default values for the Epochs, Batch Size, and Learning Rate, and these values are pre-tuned for the most common use cases to help non-technical users get good results without having too tweak complex settings.

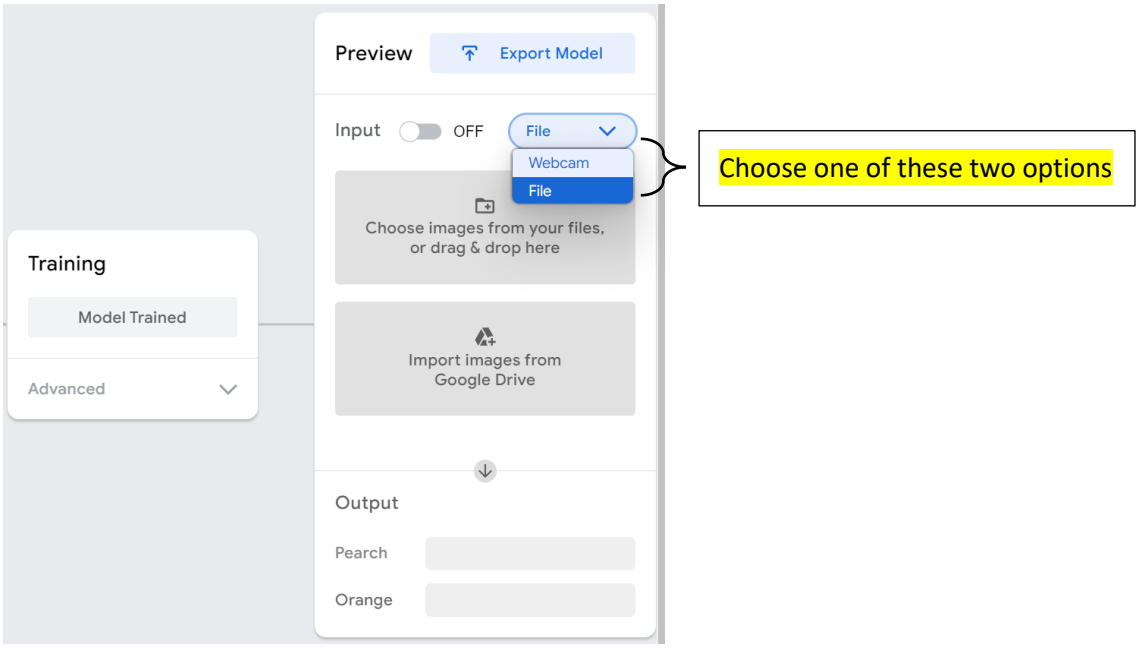
  Explanation of the settings:

  ➔ **Epochs** – refers to one complete cycle where the model learns the entire training dataset to update its learning. The more Epoch numbers you choose, the more the model learns the data multiple times, potentially improving accuracy but risking overfitting (overfitting means the model learns the training data so much that it performs poorly on new data)
  ➔ **Batch Size** – batch size determines the sample size each time the model processes before updating its parameters. A smaller batch size leads to more frequent updates, while a larger batch size leads to less frequent updates but processes more data compared to a smaller batch size.
  ➔ **Learning Rate** – the learning rate measures how quickly the model learns and adjusts and how much the machine learning model's internal parameters are adjusted with each step of training. A lower rate takes longer but provides a more precise adjustment.
  ➔ **Under the Hood** – enables you to see graphs that can help you understand how well your model is working, which means you will be able to evaluate the underlying machine learning model. Teachable Machine uses TensorFlow and Keras to build and train machine learning models. You do not have to use all of these, as most people do not.

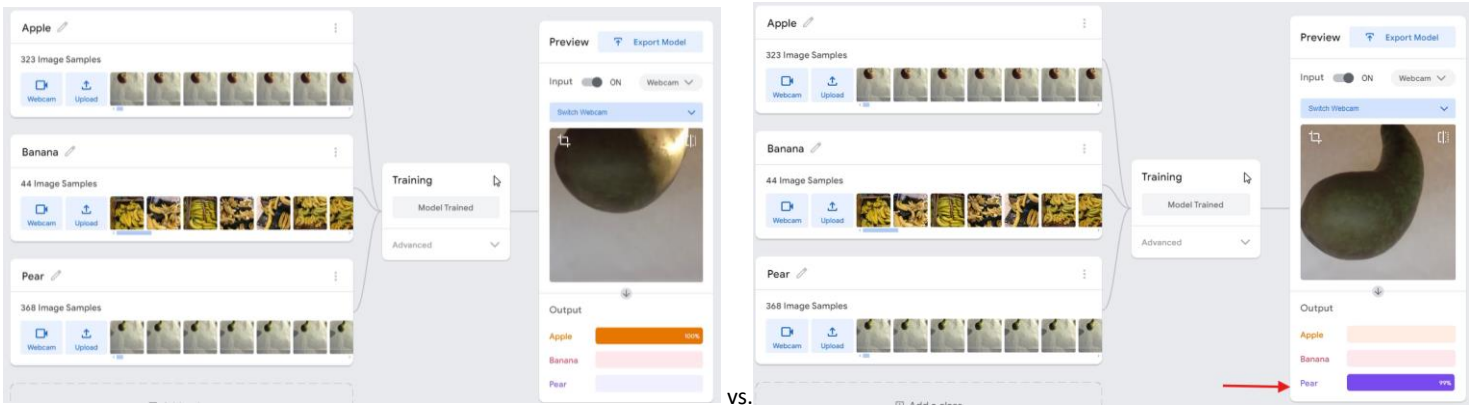
- Click on **Train Model**



- You can check if the model classifies in two ways. The first option (1) is to use the webcam and show the camera a randomly chosen fruit and see if the model detects it correctly or not. The second option (2) is to choose a file option and choose an image of a fruit to see if the model works well or not.



- You position a fruit to be detected by the web camera correctly, and if the camera does not capture the whole fruit, it could predict it wrongly. The figure below Teachable Machine predicts a pear as an apple fruit on the left. If the fruit is fully captured by the webcam, then the prediction will be the best, as illustrated below on the right.

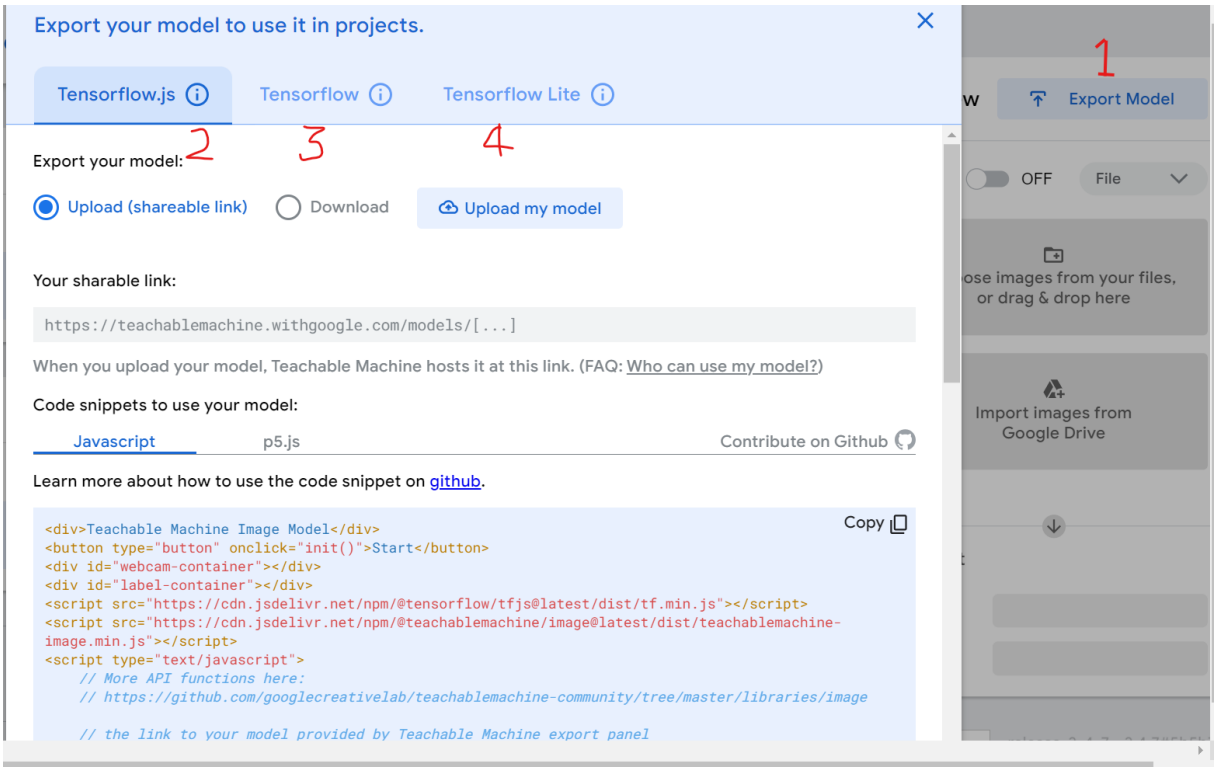


2.1 To Do: Use Teachable Machine to Create Automatic Grocery Item Detection for ICA Supermarket

You can use Teachable Machine to create a mobile app for both Android and iOS and web-based applications (this includes Desktop or Windows-based applications).

2.1.1 Use Teachable Machine to Create a Mobile App for ICA Supermarket

Open a browser → Choose a project (Image, Audio, or Pose) → Train your model as you did earlier → Export your model by selecting **Export Model (1)** → Choose **Tensorflow Lite (4)** → Click on **Download** to download the necessary files → Integrate the code into a Mobile App



2.1.2 Use Teachable Machine to Create a Web-based Application for ICA Supermarket

Open a browser → Choose a project (Image, Audio, or Pose) → Train your model as you did earlier → Export your model by selecting **Export Model (1)** → Choose **Tensorflow.js (2)** for JavaScript based web application or **Tensorflow (3)** for Python based application → Click on **Download** to download the necessary files → Integrate the code into your web application.

3 Digital Analytics to Grow Your Organization

Digital analytics enables your organization to assess and track its online performance by continuously monitoring KPIs, data-driving decision-making, and user behavior. More precisely, your organization can make informed decisions to optimize its marketing strategy and improve its user experience. Thus, digital analytics includes collecting, analyzing, and reporting digital data to understand user behavior and optimize online (digital) performance. In this exercise, we will use Google Analytics. Digital analytics includes data collection setting metrics such as sessions, users, and pageviews. On the other hand, KPIs are particular metrics that measure the fulfillment of business goals, such as user engagement and sales.

3.1 Sep-by Step Guide to Creating a Digital Analytics Dashboard

3.1.1 What Needs to be Done First?

Digital analytics involves three distinct phases: acquisition, engagement, and monetization and retention. **Acquisition** is, as the name implies, acquiring user interest by increasing or building awareness about your products and services. The second stage involves **engagement**, where users engage with your organization's app or website. Finally, **monetization and retention**, as the name implies, are when you actually get orders and purchases from your customers.

We need to do the following:

1) Determine business objectives, e.g., increase sales and increase awareness.
2) Identify the metrics to measure the fulfillment of our objectives
3) Determine your target metrics, which are crucial for the success of your organization

3.1.2 What Does Google Analytics Account Contain?

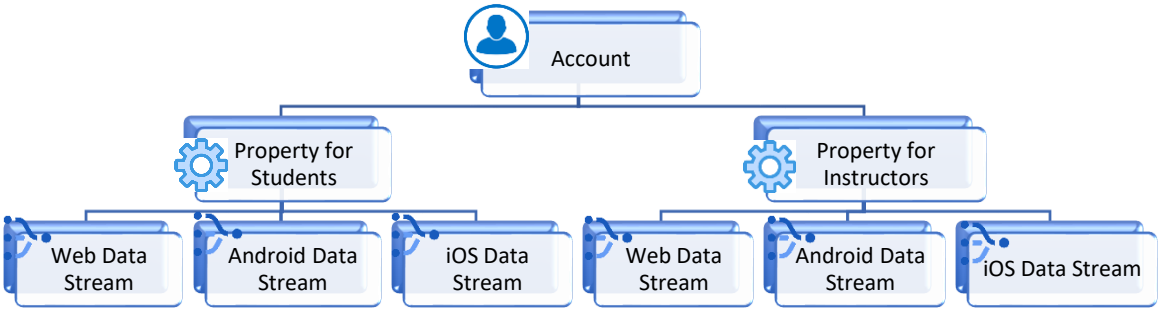
Google Analytics Account contains – Account, Property and Data Stream.

Account: represents the top-level container for organizing and managing properties (websites, apps (iOS and Android)) and controlling users.

Properties: an account contains one or more properties. A property is a mobile app or website.

Data Stream: a source of data that sends data to properties, that is data stream sends event-based data to the property and the data can come from websites and apps.

Let us take an organization that gives training for certification courses internationally. This organization has Students and Instructors. So let us see the hierarchical structure of Account-Property-Data_Streams, check the illustration below. As illustrated below, we can see that the user bases are students and instructors, thus we have two properties and each of the properties have datastreams for websits and apps.

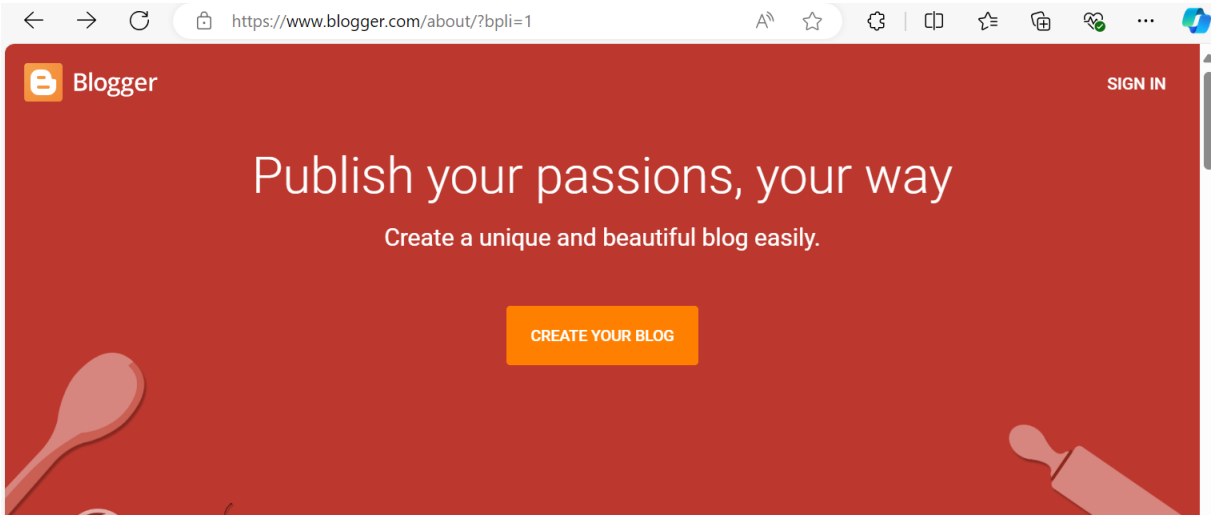


3.1.3 Creating Your Website

You can use your organization's mobile apps or websites for Google Analytics to make sense of your customer's activities. For this tutorial, we will create a blog as a substitute for an organization's website.

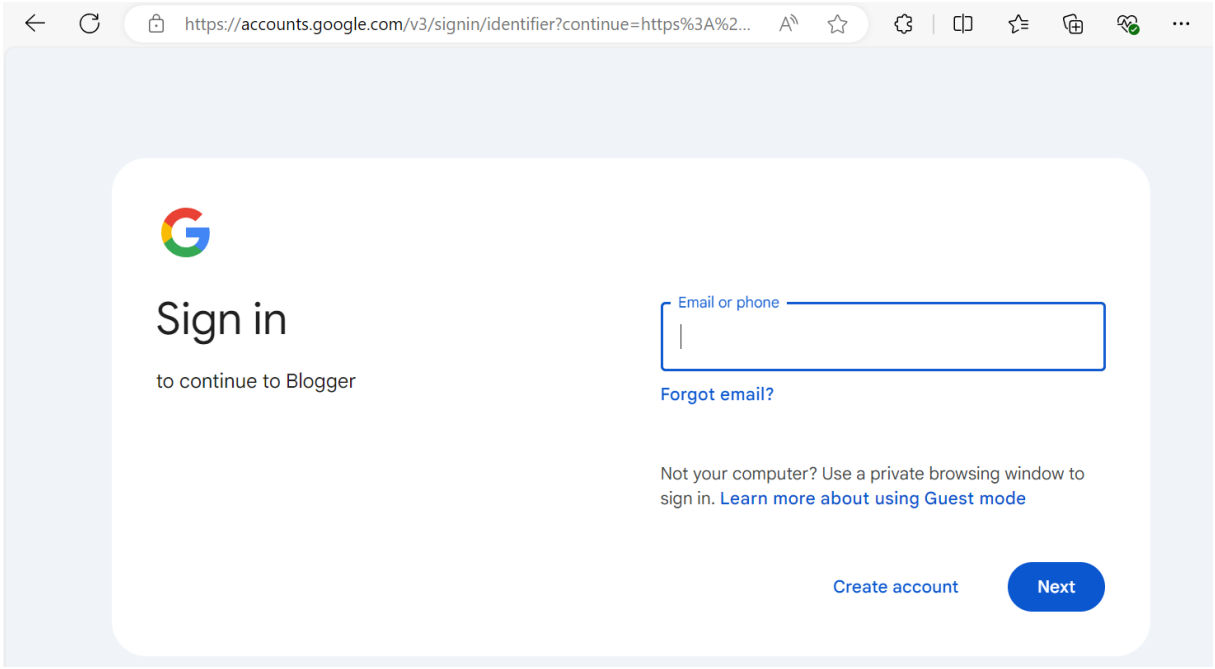
Steps: (Create a blogger account and a block for ITO-Course)

- On your browser enter the following URL: https://www.blogger.com

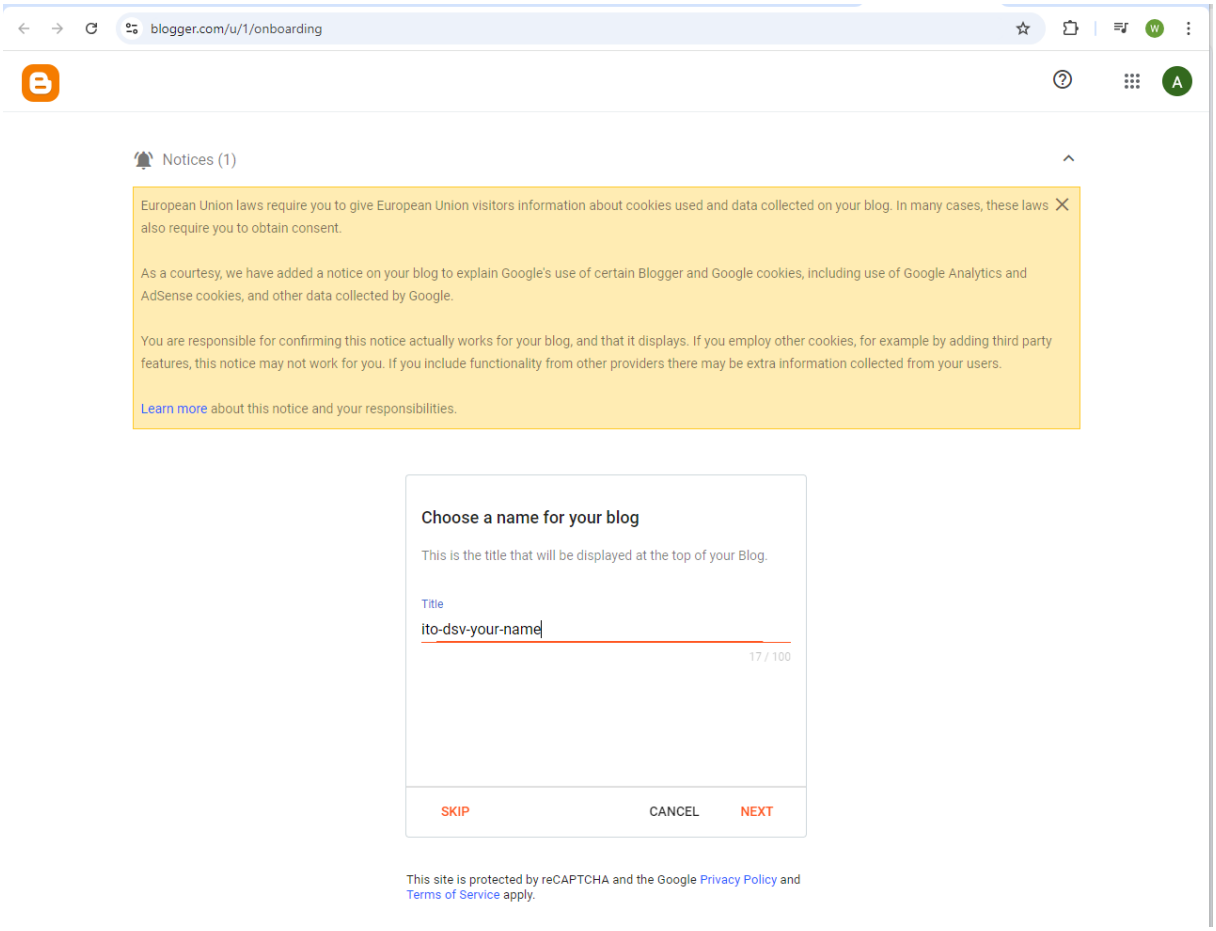


- Click on **CREATE YOUR BLOG**

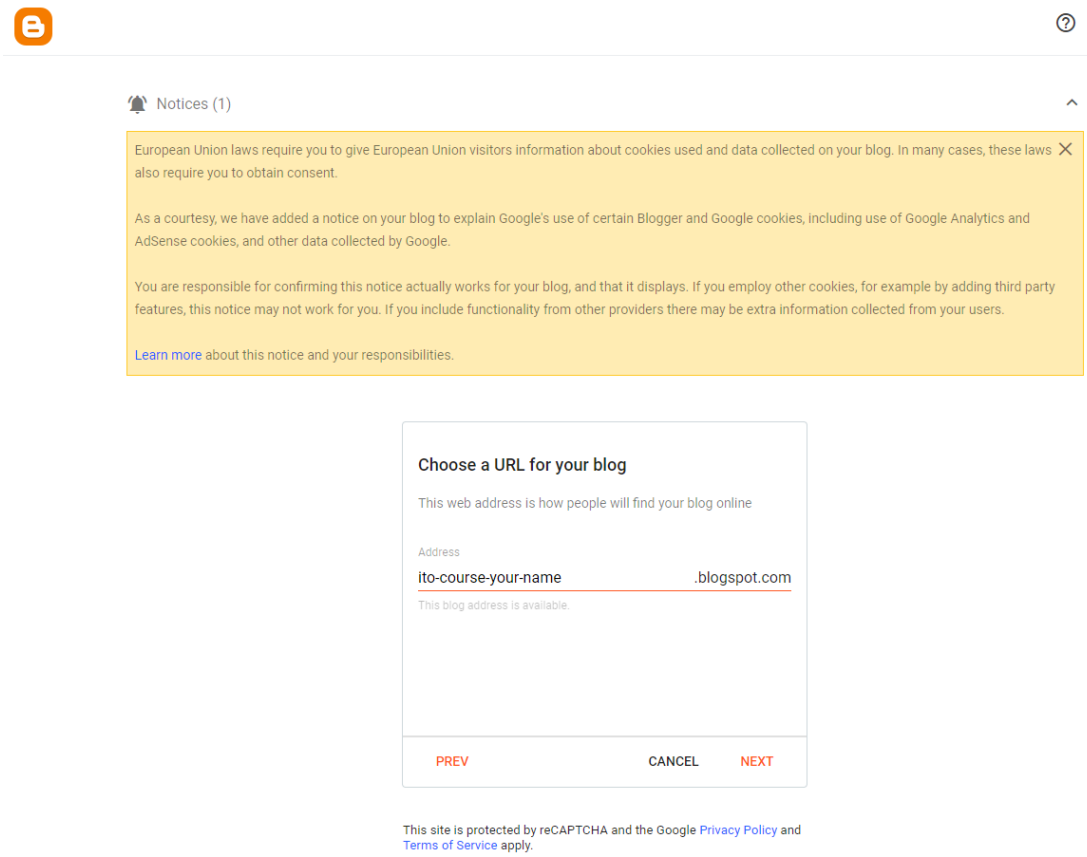
- Sign in using your Gmail account or (create a new one if you do not have a Gmail account by clicking on **Create account**)



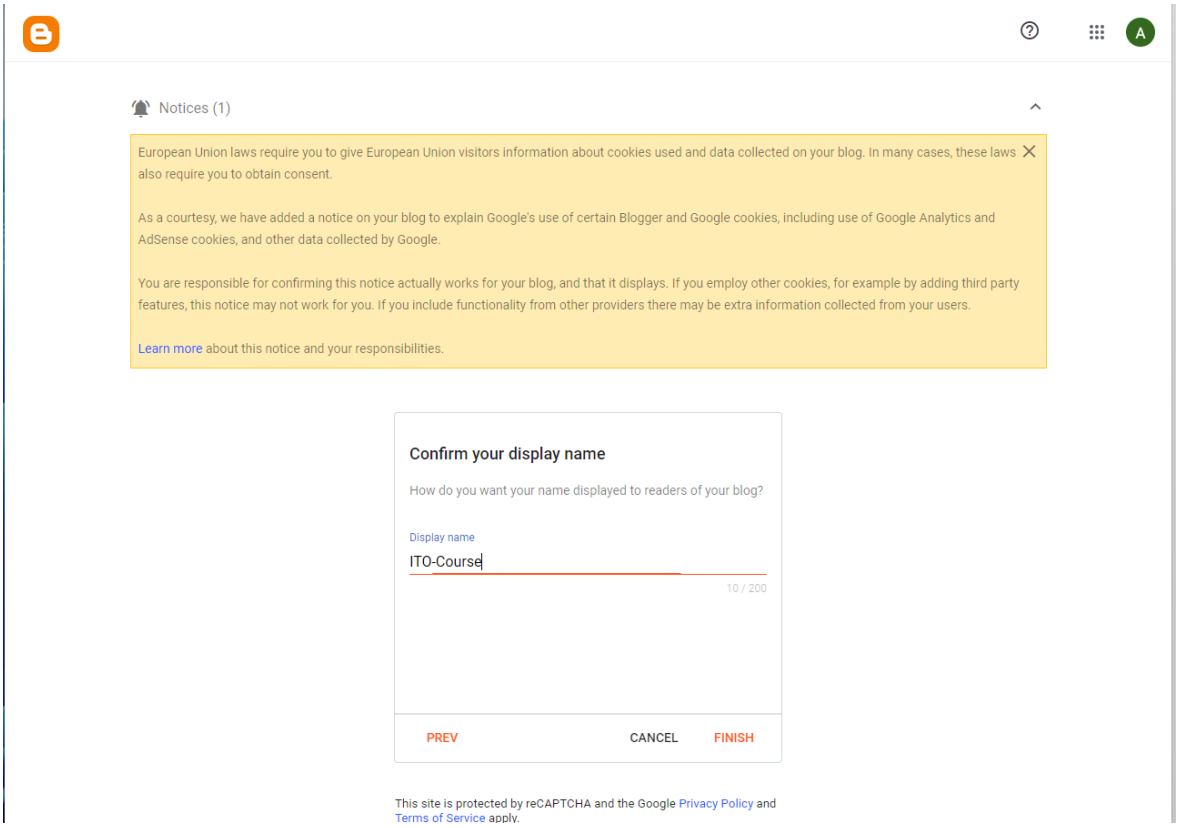
- Enter your blog's title: Example: ito-dsv-your-name > click **Next**



- Choose a URL for your blog, and please note that it must be unique. For example: ito-course-your-name

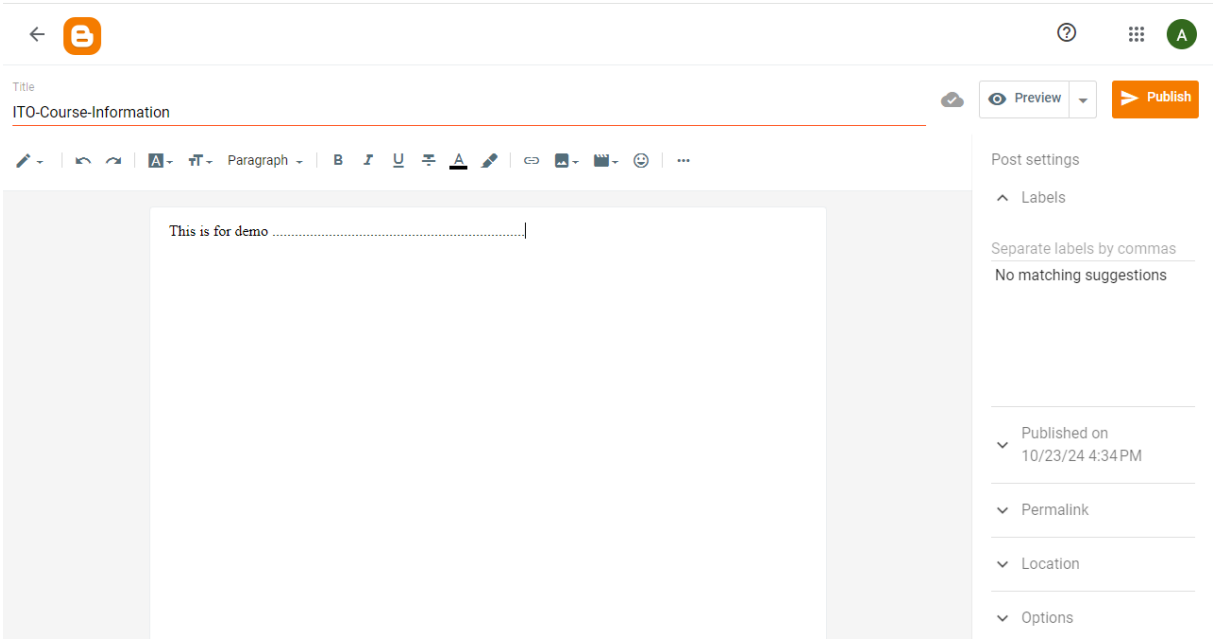


- Enter Display name: ITO-Course -> Click **Finish**

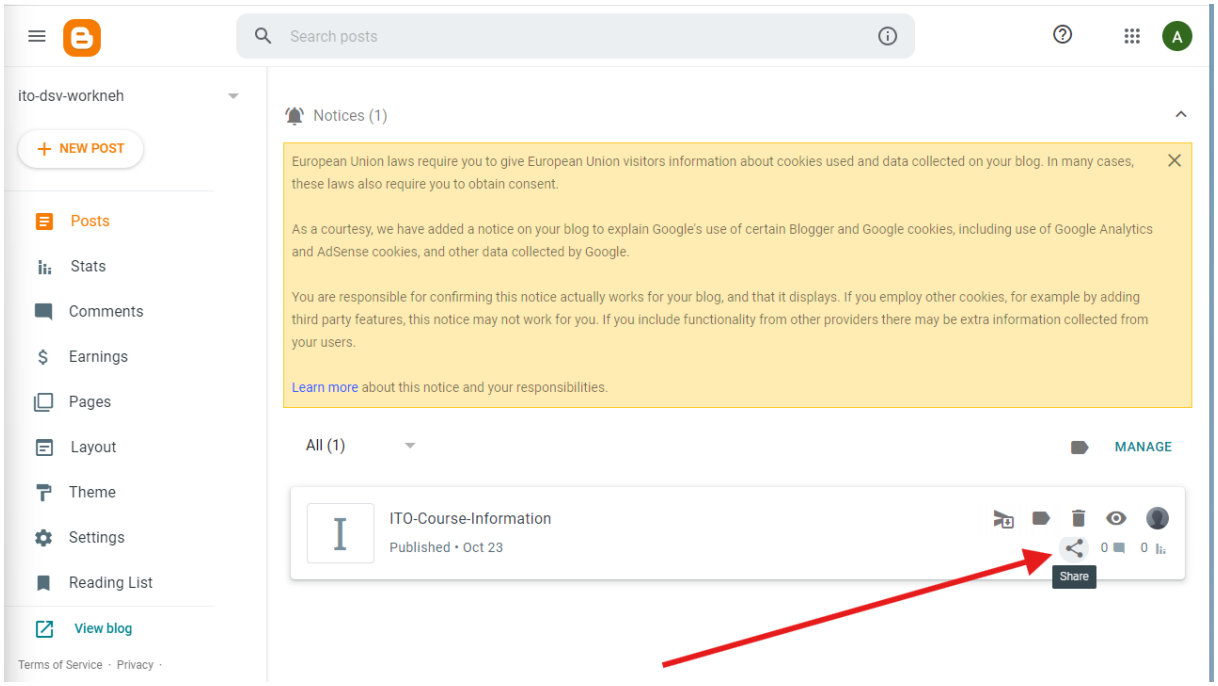


- To create a new post, click on **+NEW POST**
- Under the **Title,** enter your title: ITO-Course-Information

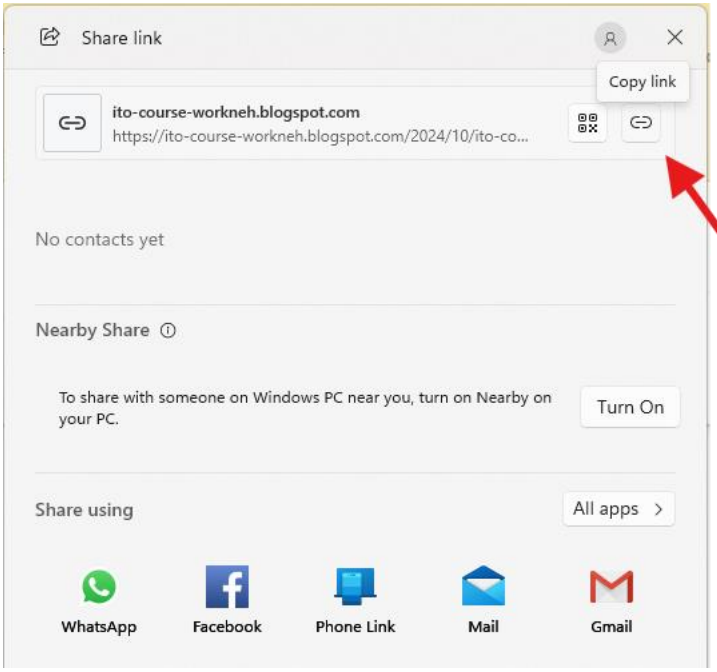
- Create the post or the content for the new post; this can include a presentation of the blog post



- Click on **Publish**
- Click on **CONFIRM**
- To copy the URL of the post and share it so that we can measure user activities, click on the share icon as illustrated below



- Click on the Copy Link icon as illustrated below:

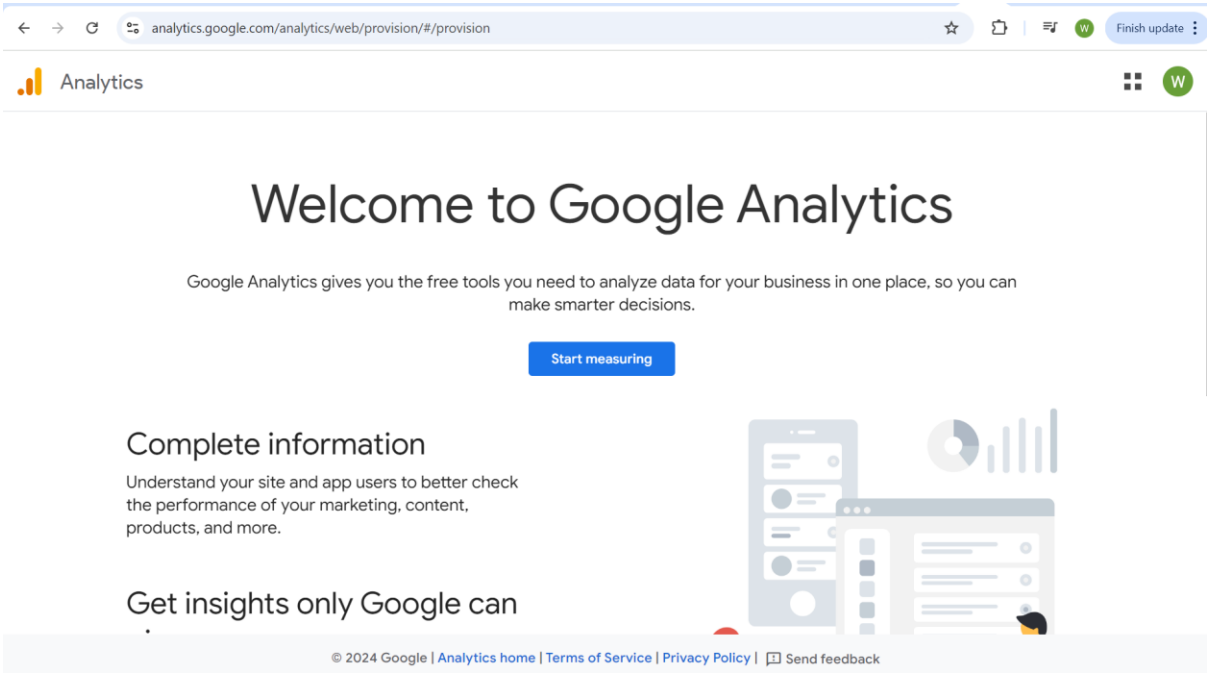


- Now, you can copy the URL and share it with your customers. In this exercise, you will share the URL and access it on your mobile device and different computers on different browsers so that we can analyze user engagement later. My URL is https://ito-course-workneh.blogspot.com/2024/10/ito-course-information.html. You must copy your different URL to use it later in the Google Analytics tool.

3.1.4 Creating a New Account for Google Analytics

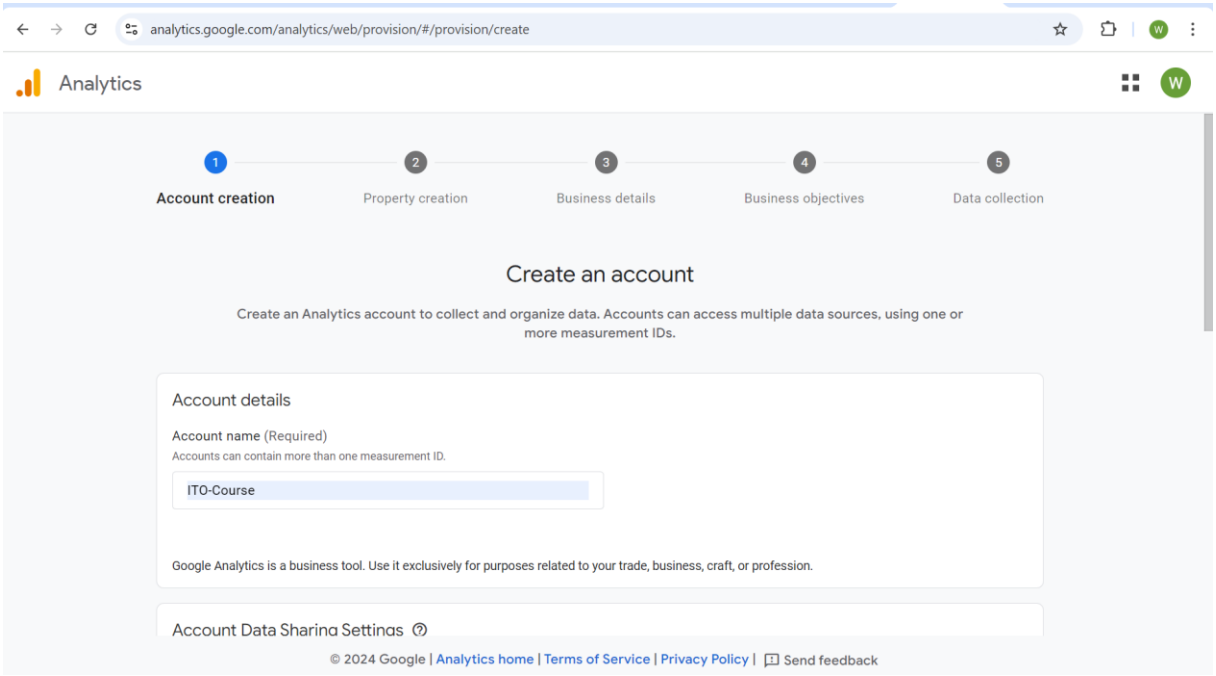
Steps:

(1) On your browser, enter the following URL: https://analytics.google.com/



(2) Click on **Start measuring**

(3) Under **Account details** in **Account name (Required) box**

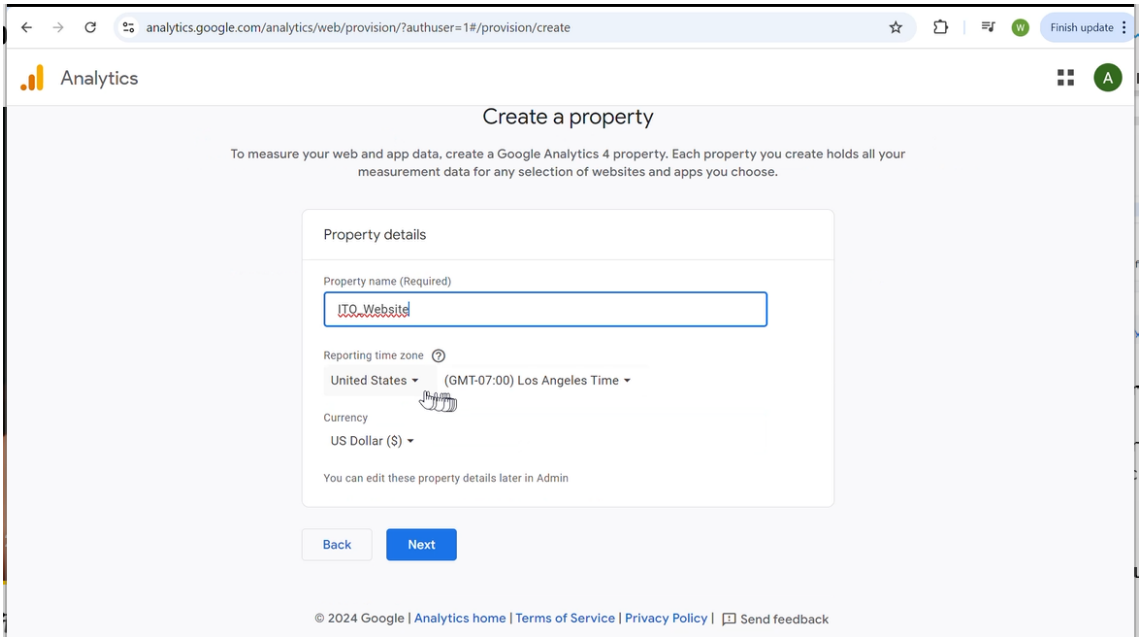


(4) Click **Next**

(5) Under the **Property details** in the **Property name (Required)** box, enter property name (ITO_Website),

(6) Under **Reporting time zone,** select your country and time zone

(7) Under **Currency** select your country's Currency



(8) Click **Next**

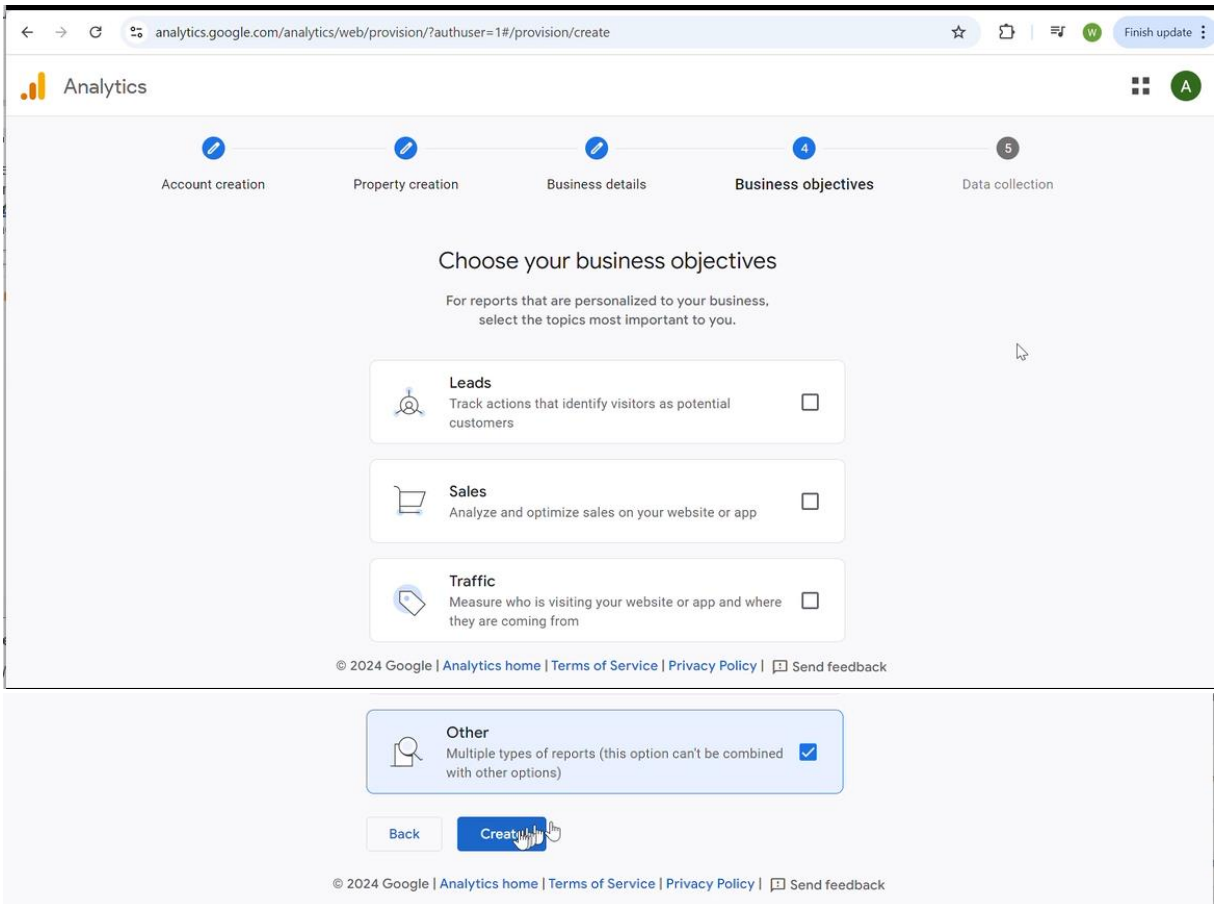
(9) Under **Business details**, select Industry category (Required), select your **Business size (Required)** -> click **Next**

(10) Under **Choose your business objectives**, select the topics most important to you for reports that are personalized to your business. In this project (SELECT **Other**).

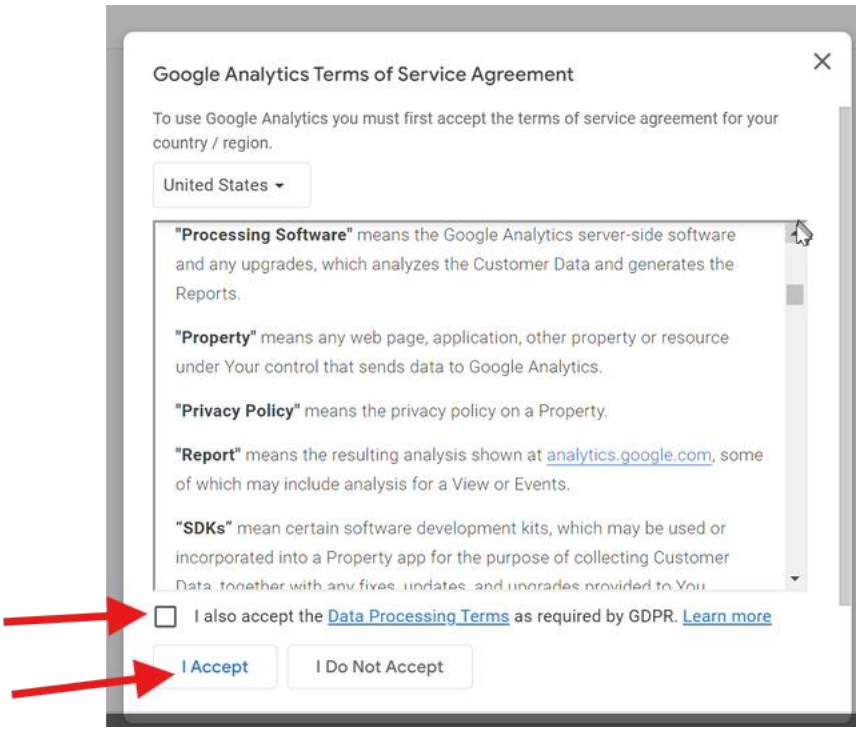
The options available are (this is for learning the available options):

a. **Leads** (to track actions that identify visitors as potential customers) and/or
b. **Sales** (to analyze and optimize sales on your website or app) and/or

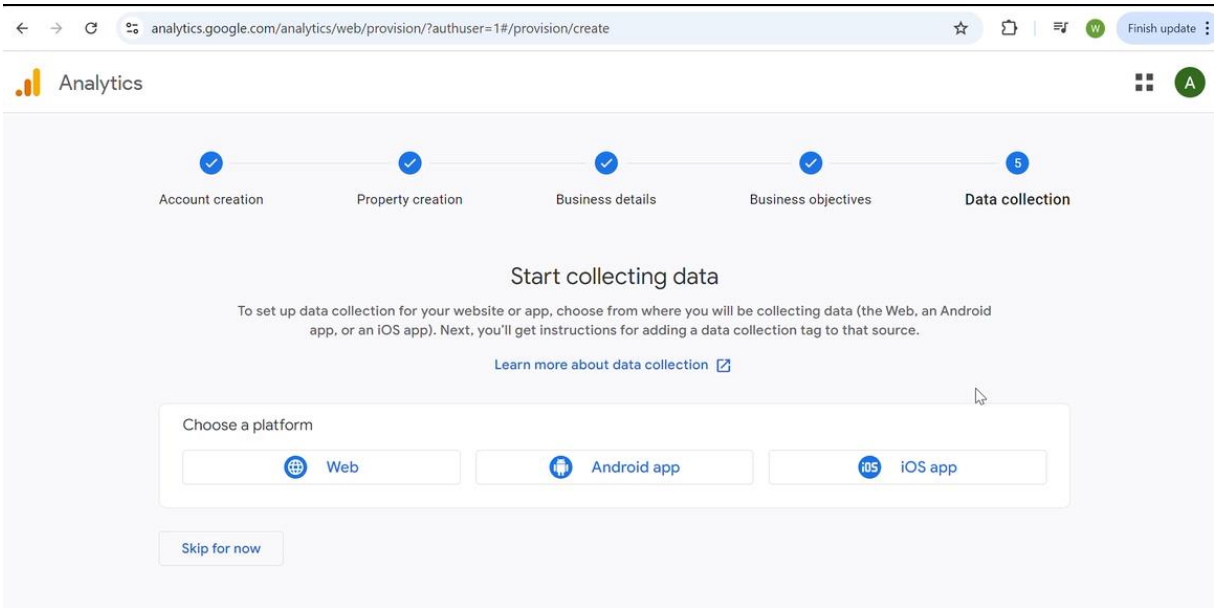
c. **Traffic** (to measure who is visiting your website or app and where they are coming from) and/or
d. **User engagement & retention** (learn how people explore your products or services) and/or
e. **Other** (to have multiple types of reports, and this option cannot be combined with other options) – if you choose this option, you cannot choose any other option.



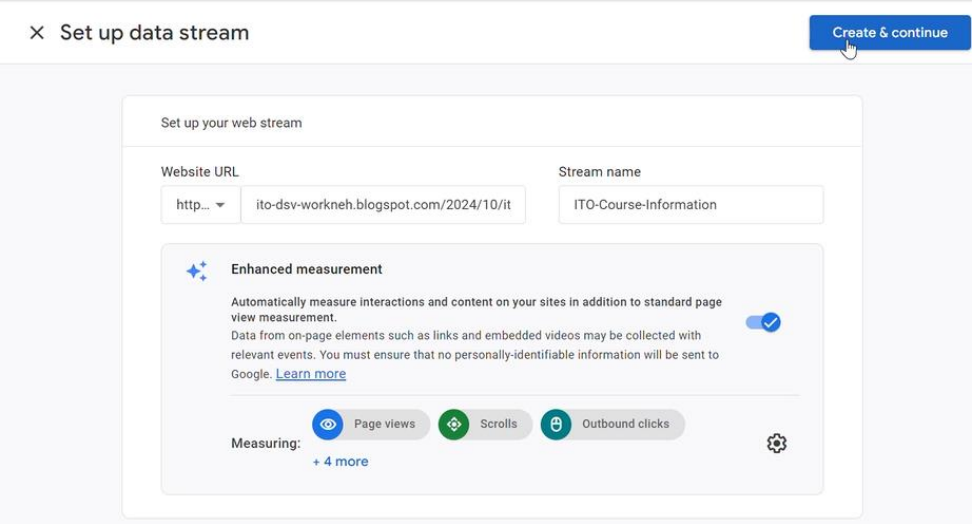
f. Check **I also accept the Data Processing Terms as required by GDPR.**
g. Click on **I Accept**



h. Set up data stream > Choose Web as your platform now is the web

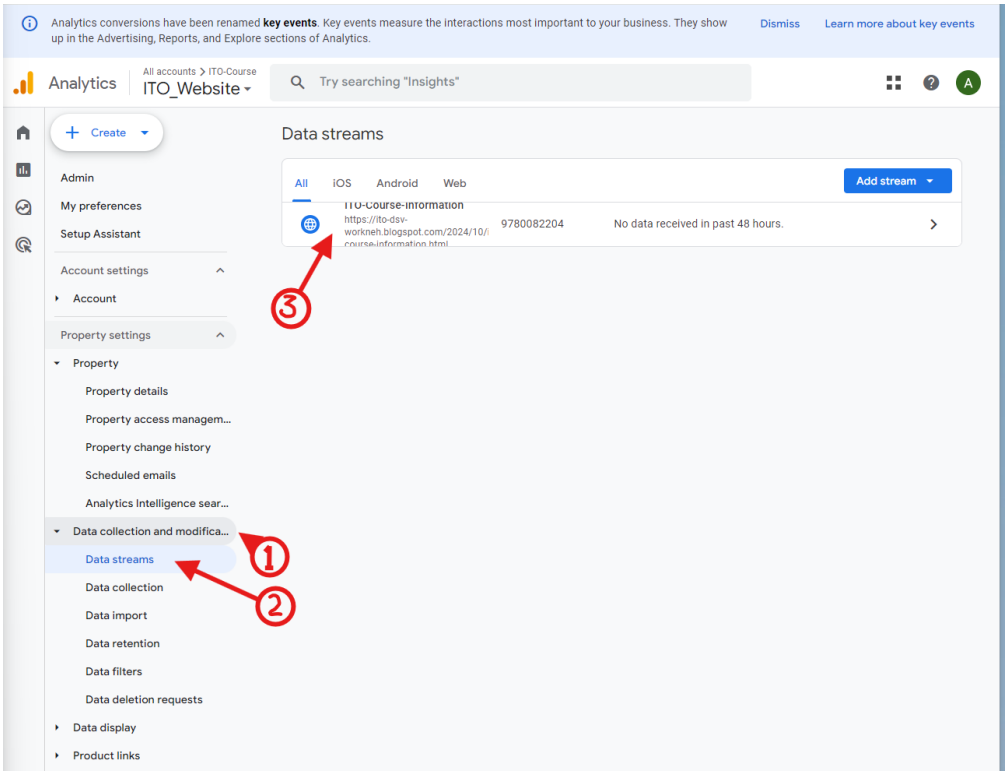


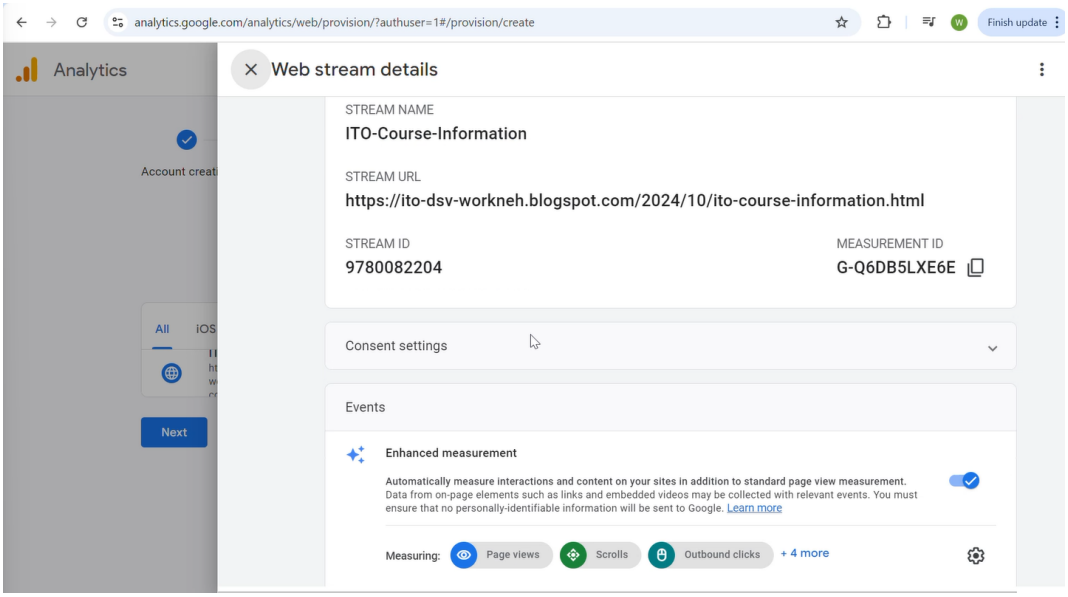
i. Enter the **Website URL** (you copied the website URL earlier) and **Stream name** as illustrated below:



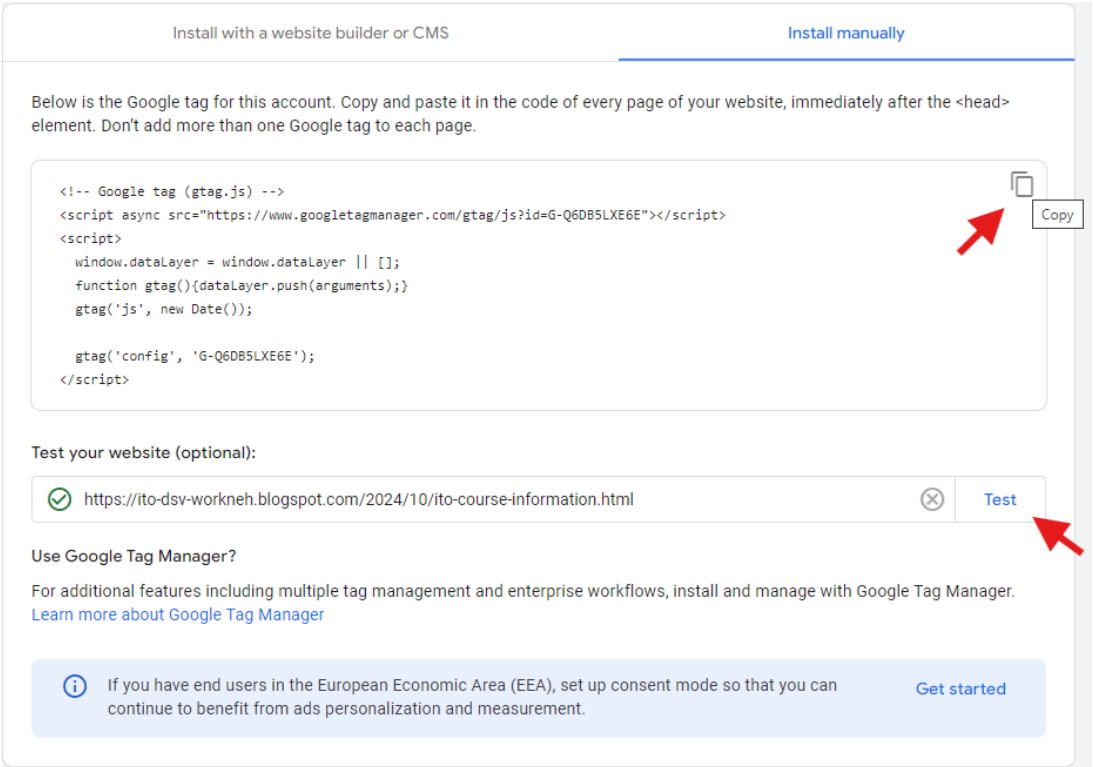
j. Click on **Create & continue**

If you do not see the Web stream details, click on the created Data stream URL as illustrated bellow.

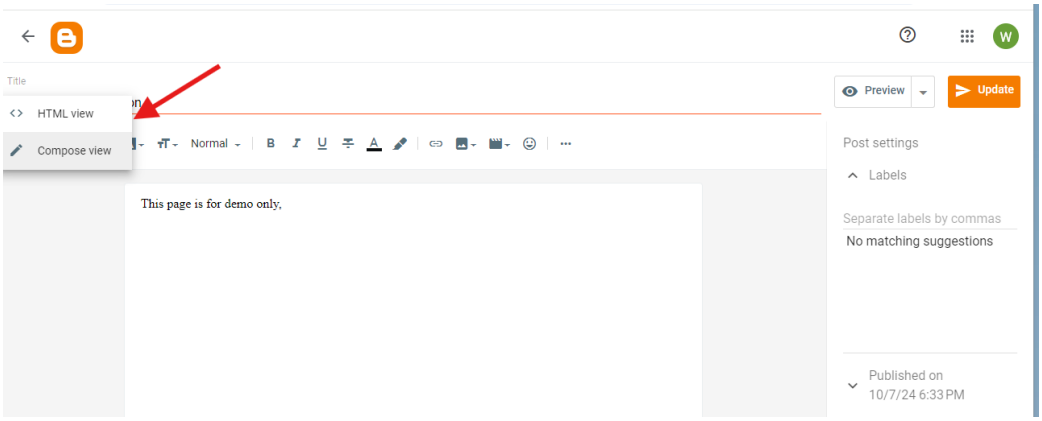




k. Click on **View tag instructions**
l. Click on **Install manually.** (*If you are using CMS (content management systems) such as WordPress, Wix, or Square Space, you can click on Select your platform and continue connecting your website with Google Analytics.*)
m. Click on Test <- to check your website
n. Copy the code tag by clicking on the copy icon on the corner, as illustrated below

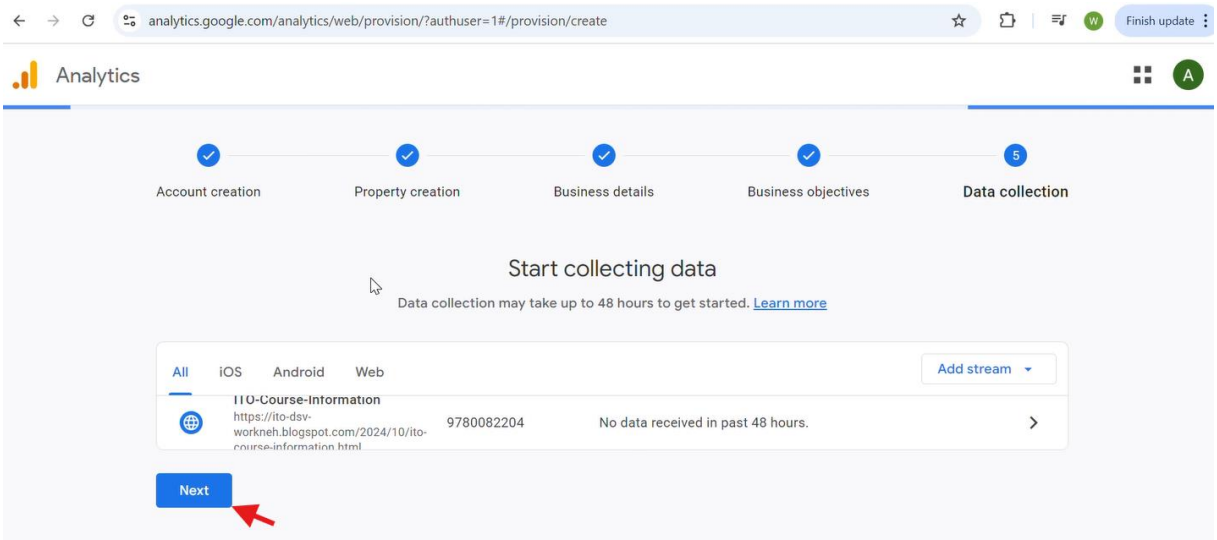


o. You need to paste this **JavaScript** code on every page of your website
p. Go to your blogger.com to edit your post > open the post
q. Change your view to **HTML view** from **Compose view**, as illustrated below

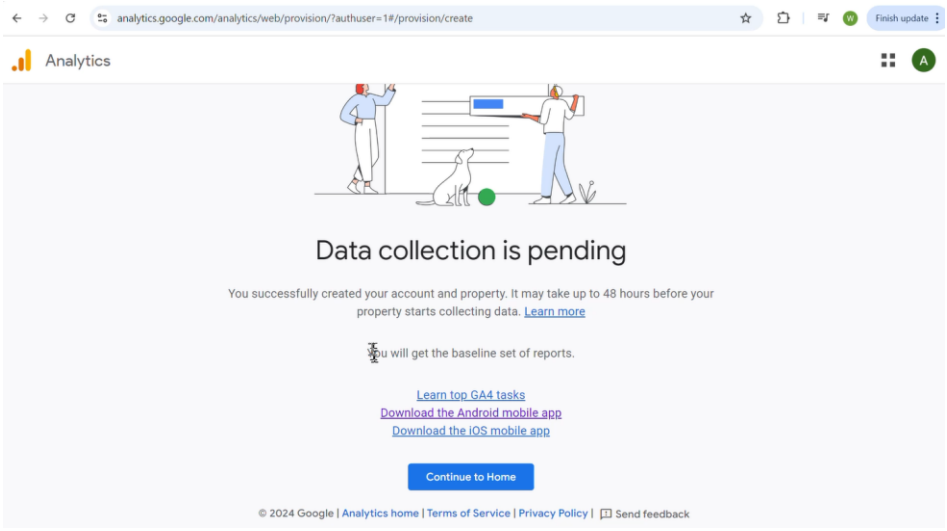


r. Paste the **JavaScript** code as illustrated below.

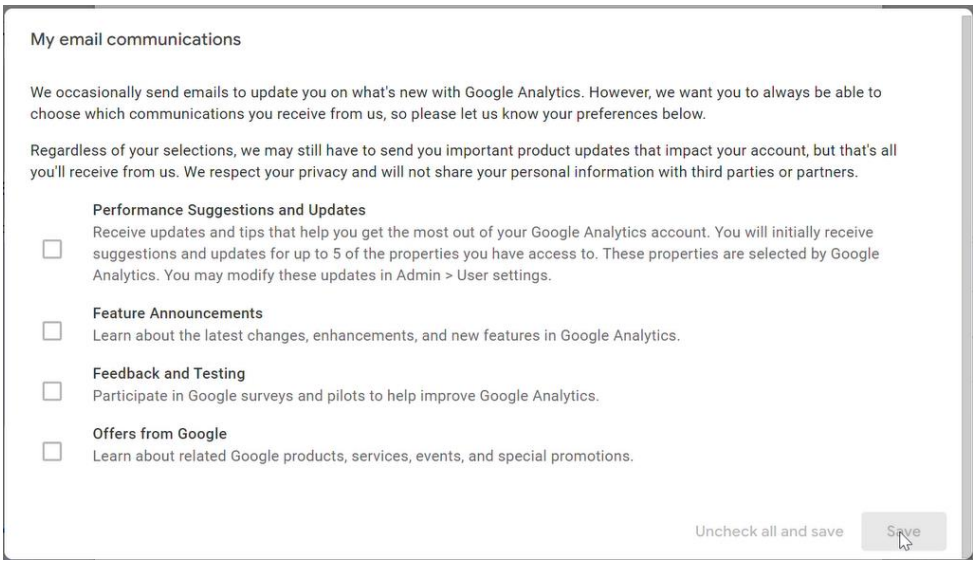
s. Change to **Compose view**
t. Click on **Update**
u. Switch back to your Google Analytics website -> close **Installation instructions** and **Web stream details**



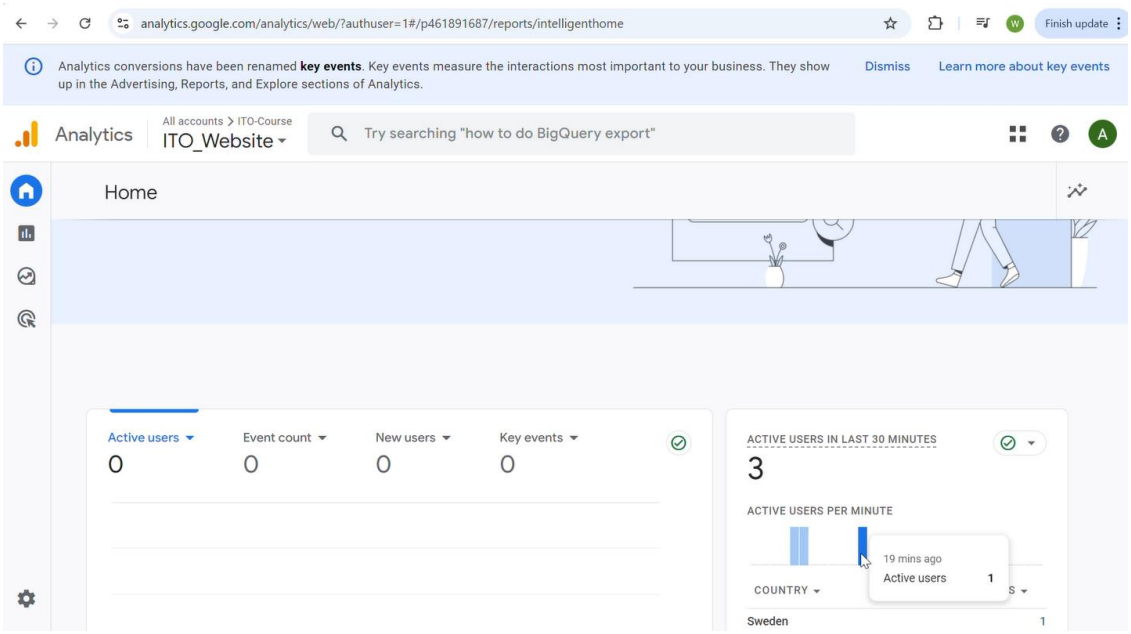
v. Click on **Next**



w. Click on **Continue to Home**

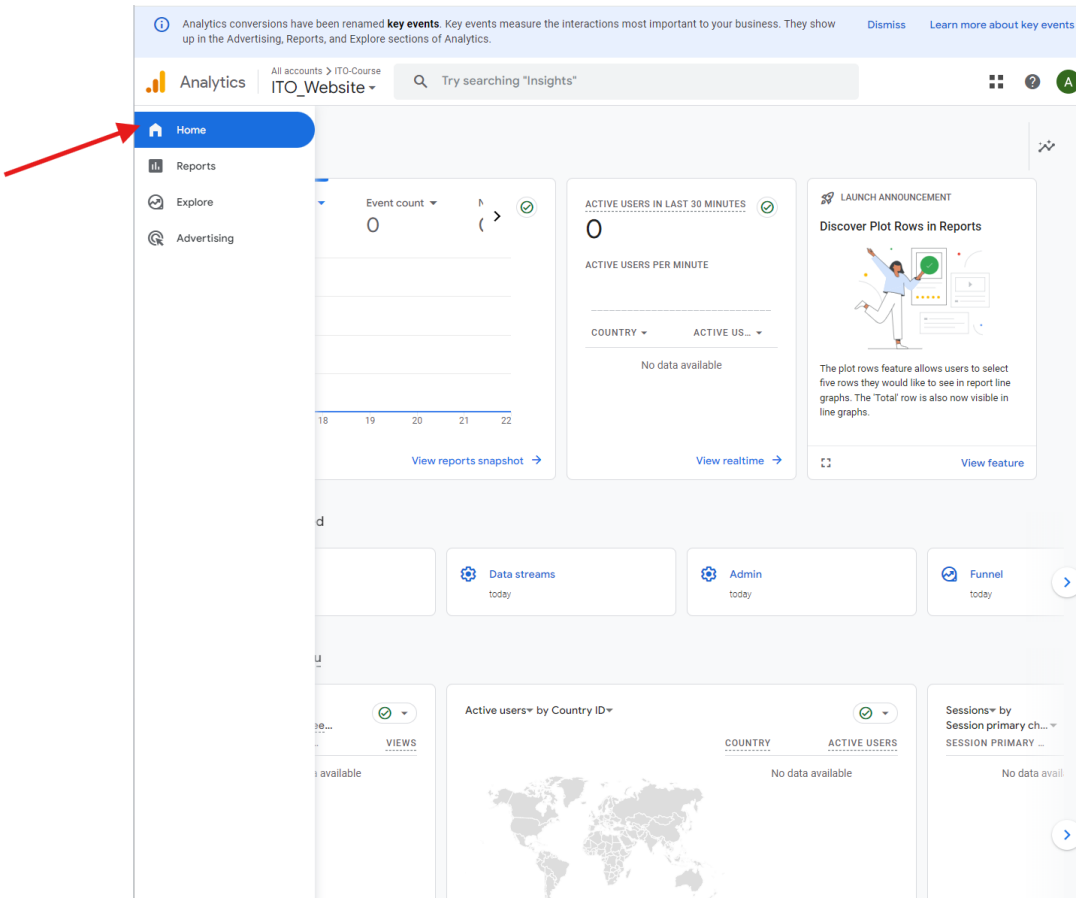


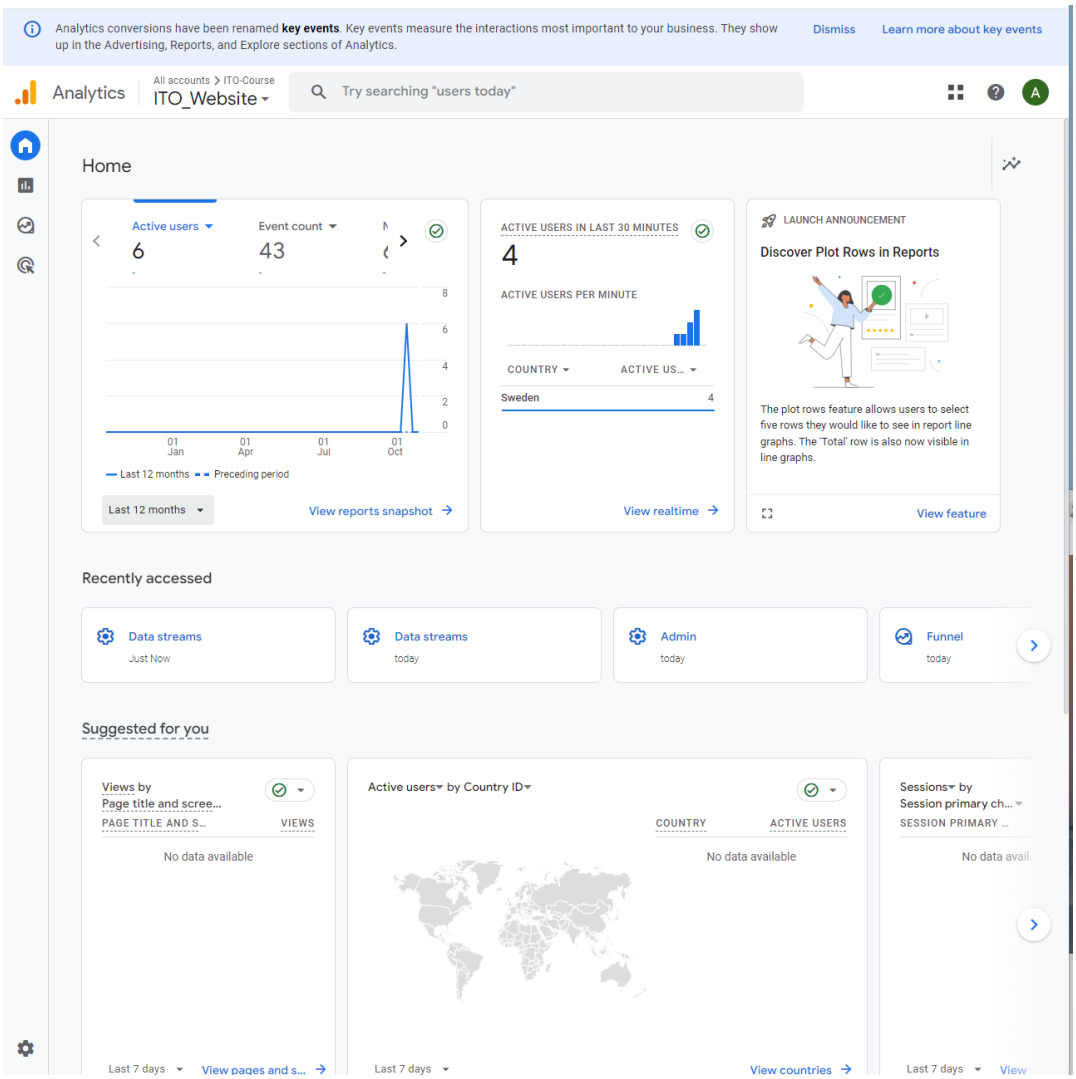
x. If a dialog prompts you to check options as illustrated above, Click on Save and make sure that you get to the dashboard where you see the analytics page as illustrated below. You can see that you have no active users, event counts, new users, key events, etc.



y. Open the blog post on different types of browsers and devices to see the analytics and visualizes customer/user interactions

z. To check the status > click on Home





You can use the insight from Google Analytics to make informed decisions regarding your customers'/users' engagements.

3.2 To Do: Create a Dashboard to Visualize Your Data Gathered from Your Website or App Data for ICA-Nacka

- Create a new post for ICA-Nacka supermarket with some information about its location, including geolocation and contact information.
- Create a new account called ICA-Nacka.
- Create a property
- As discussed in the previous section of this manual, create and configure a web data stream.
- Take snapshots of your blog, a copy of its URL, and a snapshot of your data stream details and visualizations, and submit it to nextiLearn.