

Istituto di Istruzione Secondaria Superiore - Seriate (BG)

ARTIFICIAL INTELLIGENCE

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Subjects links:

- **Inglese**: the Alan Turing test by “The Turing Guide”;
- **GPO**: usage of artificial intelligence to build customer loyalty;
- **Informatica**: usage of databases for machine learning;
- **TPS**: dynamic web-pages to allow the use of Artificial Intelligence;
- **Sistemi e reti**: usage of MD5 to protect data saved on a website.

Project:

realization of a website in HTML, CSS and JavaScript, connected to a database in MySQL with server-side scripting in PHP. Usage of MD5 to store passwords safely.

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1. Introduction to Artificial Intelligence

Artificial intelligence (AI) is a wide-ranging branch of computer science concerned with building machines capable of performing tasks that typically require human intelligence (such as learning and problem-solving). The ideal characteristic of artificial intelligence is its ability to rationalize and take actions that have the best chance of achieving a specific goal.

2. History and milestones

To better understand what Artificial Intelligence is, we should trace its beginnings. AI was born back in 1956. During this time, all the researchers who dealt with understanding how to simulate the human mind through machines organized a meeting at Dartmouth College (New Hampshire, USA).

The meeting highlighted some shocking values, especially in the field that aimed to make the machines reproduce the process of consolidating various scientific theories, considered a typical intelligent behavior. In particular, Herbert A. Simon's work with his "Logic Theorist" was appreciated. It successfully proved 38 out of 52 theorems of Russell and Whitehead's "Principia Mathematica" (all-time great philosophers).

During those years, McCarthy (US senator of Wisconsin) defined a specific programming language called LISP (LISt Processor) to solve AI problems. This language allowed the creation of multiple programs in the AI field in different domains. An example is *Student*, which solved algebraic problems in phrase form. Another one is *Dendral*, which solved chemistry problems.

Another milestone of AI is the ELIZA program. This program simulated the interaction between a Rogerian therapist (a therapist that doesn't express himself but leads the patient to understand himself on his own) and a patient. Most of the patients had been convinced that they were talking to an actual therapist, so this machine passed the Turing test. On the other hand, the phrases that this machine told the patients were only the fruit of conscious matching of keywords said by the patient. So despite passing the Turing test, it was hard to declare this program intelligent.

In the 70s, multiple programs called "open systems" were created. The idea was to focus on a specific domain and to simulate the behavior of an expert in that field. A typical example was MYCIN, an open system capable of successfully diagnosing infectious blood diseases.

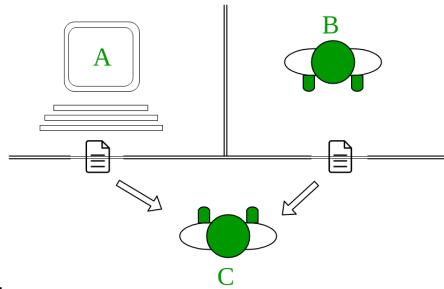
Furthermore, the desire to simulate experts' knowledge in specific domains has also driven attempts to give a machine a more general knowledge and "common sense". This was the case of CYC, a project born in 1983 and still not complete today, that collected millions of facts and knowledge bases, with the scope of generating a machine that could think, at least, like a child of 6 years.

3. The Turing Test - English

A decade after breaking the Nazi encryption machine *Enigma*, and thus helping the Allied Forces win the Second World War, Alan Turing asked himself a simple question, “How can researchers tell if a computer is capable of thought?” That is not an easy question, considering that science still doesn’t even know what is going on inside our own brains. But even if it did, would it really be clear whether entities without a human brain can think? Turing believed that, in order to tell whether a computer thinks or not, we only have to look at what it does, without caring about what processes are going inside it.

He suggested a kind of “driving test” for thinking, an examination that pays no attention at all to whatever causal processes are going on inside the candidate, just as the examiner in a driving test cares only about the candidate’s car-handling behaviour, and not at all about the nature of the internal processes that produce that behaviour.

Turing called his test the “imitation game”, but nowadays it is known universally as the “Turing Test”. Turing’s test involves three players: the candidate and two human beings. One of the humans is the examiner or judge; the other (the foil) serves as a point of comparison. The judge has to try to figure out which of the other two participants is which, human or non-human, simply by chatting with them via keyboard. The foil’s job is to help the judge make the right identification. A number of chat sessions are run using different judges and different foils, and if the judges are mistaken often enough about which contestant is which, the computer has passed the test.



Justifying his test, Turing pointed out that the judges can use keyboard chat to probe the computer’s skills in almost all fields of human endeavour. His examples included mathematics, chess, poetry and flirting. No questions are barred, the computer must be able to deal fair and square with anything the judge throws at it.

The computer is also allowed to use “all sorts of tricks” to bring about a wrong identification. Smart moves for the computer are to reply “no” in response to “Are you a computer?” and to follow a request to multiply one huge number by another with a long pause and an incorrect answer (but a plausibly incorrect answer, not simply a random number).

The Turing test is extremely tough for a computer to pass. We humans find idle chit-chat across the dinner table easy, but if one steps back and considers what is involved one realizes that, even in quite trivial conversations, we are manipulating vast amounts of knowledge, and are effortlessly producing and comprehending complex linguistic structures, as well as handling irony, metaphors, humor or unfinished sentences. None of these are things that today’s computers excel at.

4. Artificial Intelligence to build customer loyalty - GPO

Customers, nowadays, expect maximum quality services and an easy way to achieve their goals. It should be the priority of any business to optimize all of its processes to ensure the greatest level of customer satisfaction and to increase customer loyalty.

Nowadays we are witnessing the growth of technologies that may bring many potential business benefits, but which also pose a number of threats. One of these is Artificial Intelligence, which delivers three key business advantages.

It allows us to look for inter-relationships we might not otherwise be able to program into standard predictive models, the performance of these models often improve because of AI's ability to learn by analyzing the results of earlier decisions.

This new approach to data analysis opens up new opportunities for customer personalization, resulting in better matches between products/services in the portfolio and specific client needs. With the use of AI you can now recommend customized discounts, products or services that best meet the needs of an individual customer and do so on the basis of an analysis of the customer's own behavior and that of other buyers with a similar profile.

AI models may also tell us how best to customize our offer to target selected customers, based on their previous orders. The process does not rely solely on the fact that a given product has been purchased but it also relies on the appearance of the given item in order to suggest similar products.

Chatbots are another area in which the development of AI is rapidly growing. Chatbots can be simple decision-making pathways that allow customers to obtain information by choosing predefined queries, but they may also be "smart" and understand a language. Chatbots can be much better than humans with the customers for many reasons: with the use of specific tools they can instantly analyze the entire record of past interactions with the user, giving aimed advice. Something important in AI chatbots is their ability to "learn" from past interactions, in order to improve exponentially without requiring additional work on the programming-side.

The rapid advances in speech recognition softwares and technologies has driven the popularity of Virtual Assistants, such as Google Assistant, Amazon Alexa or Siri. VAs have achieved very good sales results which are expected to grow.

With the implementation of areas of communication between companies and customers, AI is going to have a big impact on the way customers perceive their interactions with brands. This will lead to greater customer satisfaction and loyalty.

5. Machine learning and databases - Informatica

Machine learning is a branch of Artificial Intelligence that focuses on the study of computer algorithms that improve through experience and by the usage of data; computer systems that use machine learning are able to learn and adapt without following explicit instructions by using algorithms and statistics to analyse and calculate the best options. The set of data loaded into the system before starting the “learning process” is called “training data”.

To implement machine learning, it's important to have a place to store all the inputs and outputs, this is where databases come in. A database is a systematic collection of data managed by a DataBase Management System, or DBMS. The DBMS is a system software able to manipulate collections of data that are big, shared and persistent, guaranteeing reliability and privacy. A DBMS also needs to be efficient and effective.

Databases differ on the type of correlations between the data.

- The most common on the market is the relational database. This type of database defines database relationships in the form of tables. Examples of relational systems are MySQL, Oracle and Microsoft SQL. MySQL is also the database I used for my project.
- NoSQL is a database used for large sets of distributed data. This type of computer database is very efficient in analyzing large-size unstructured data. An example of a noSQL database is MongoDB.
- Graph database is a database that uses graph structures for semantic queries with nodes, edges, and properties to represent and store data. A key concept of the system is the graph. Graph databases are mostly used in the social media field.

6. Dynamic web pages - TPS

Dynamic web pages are web pages that display different content each time they're viewed. For example it can show the date or time of the day, the user that accesses the page, or other set context depending on the client input. There are two types of dynamic web pages.

Pages that change in response to an action happening in that web page, like a click or a keyboard press, use client-side scripting. These pages use content that's generated on the user's computer rather than the server. In these cases, the user's web browser would download the page from the server, execute it and only apply the code already embedded with it. Languages that allow client-side scripting are JavaScript and Flash.

Pages that change when a page is loaded use server-side scripting. Server-side content is generated when a page is loaded. For example shopping carts, login pages or forums all use server-side scripting, for which the data is retrieved from the server. Languages that allow server-side scripting are PHP, JSP and ASP.

With the usage of server-side scripting it is possible to include Artificial Intelligence in a website. Examples include chat-bots that interact with the users, a background system that calculates the website analytics, or one that calculates the best and worst products based on customer response.

7. Website project

To illustrate the practical side of web pages I built a website for a sushi shipping service. To create the website I used HTML, CSS, JavaScript and PHP, connected to a database in MySQL. I will personally bring my project to the oral exam.

7.1 HTML and CSS

HTML (HyperText Markup Language) and CSS (Cascading Style Sheets) are languages on the client-side scripting and are at the core of website creation. HTML builds the structure, or “skeleton”, of the page and CSS builds its layout. HTML and CSS are the basis of Web pages and Applications developing.

7.2 JavaScript

JavaScript is a language used both on the client and server side (in my case I used it only on the client-side) that allows web pages to be interactive. While HTML and CSS are languages that create the structure and style of the page, JavaScript gives pages elements the user can interact with. Incorporating JavaScript improves the user experience and converts the page from a static to an interactive one.

7.3 PHP and MD5 - Systems and networks

PHP is a server-side language, used to create dynamic and interactive web pages. PHP is widely-used to create such web pages. It allows the connection between web pages and databases. I used PHP to store account information in the database, like usernames and passwords of the users. To ensure data protection and privacy on the database I used the MD5 function in PHP to encrypt the passwords saved in my database in order to prevent access in case of eventual hacks to the database.

MD5 or Message Digest 5 is a one-way hashing algorithm used to encrypt data. MD5 was invented by Ronald Rivest in 1992. Its most important feature is that, no matter the length of the initial string, the output string will always be of 32 characters (or 128 bits) and it is called an MD5 checksum.

The way MD5 works is by following a strict list of steps:

1. Appends padding bits to the original message;
2. Appends length, used to record the original input length;
3. Initializes MD buffer;
4. Processes message in blocks of 16 words.

At the end of the processing, the buffer contains the message digest.

7.4 MySQL

MySQL is an open-source relational database management system. As a relational database, MySQL stores data in tables made up of rows and columns. It allows data definition, manipulation, control and query using SQL (Structured Query Language). In my database, I stored information like users' data, ingredients, dishes and the shopping carts of the users.

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1956 meeting in Dartmouth



LISP

ELIZA

Open Systems

CYC

LISP

McCarthy created LISP



ELIZA

Welcome to

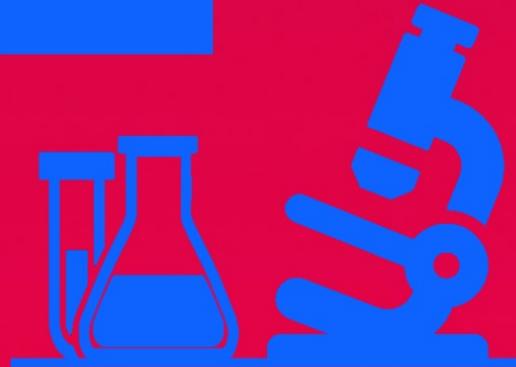
```
EEEEEE LL      IIII    ZZZZZZ  AAAAAA  
EE      LL      II      ZZ      AA      AA  
EEEEEE LL      II      ZZZ     AAAAAAAA  
EE      LL      II      ZZ      AA      AA  
EEEEEE LLLLLL IIII    ZZZZZZ  AA      AA
```

Eliza is a mock Rogerian psychotherapist.
The original program was described by Joseph Weizenbaum in 1966.
This implementation by Norbert Landsteiner 2005.

```
ELIZA: Is something troubling you ?  
YOU: Men are all alike.  
ELIZA: What is the connection, do you suppose ?  
YOU: They're always bugging us about something or other.  
ELIZA: Can you think of a specific example ?  
YOU: Well, my boyfriend made me come here.  
ELIZA: Is it important to you that your boyfriend made you come here ?  
YOU: He says I'm depressed much of the time.  
ELIZA: I am sorry to hear that you are depressed.  
YOU: It's true. I am unhappy.  
ELIZA: Can you explain what made you unhappy ?  
YOU:
```

Open Systems

Creation of MYCIN



CYC

To give machines "common sense".

1,2,3,4...



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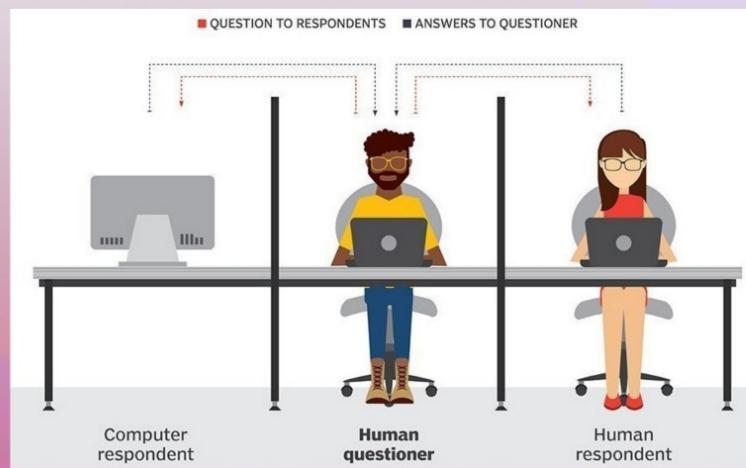
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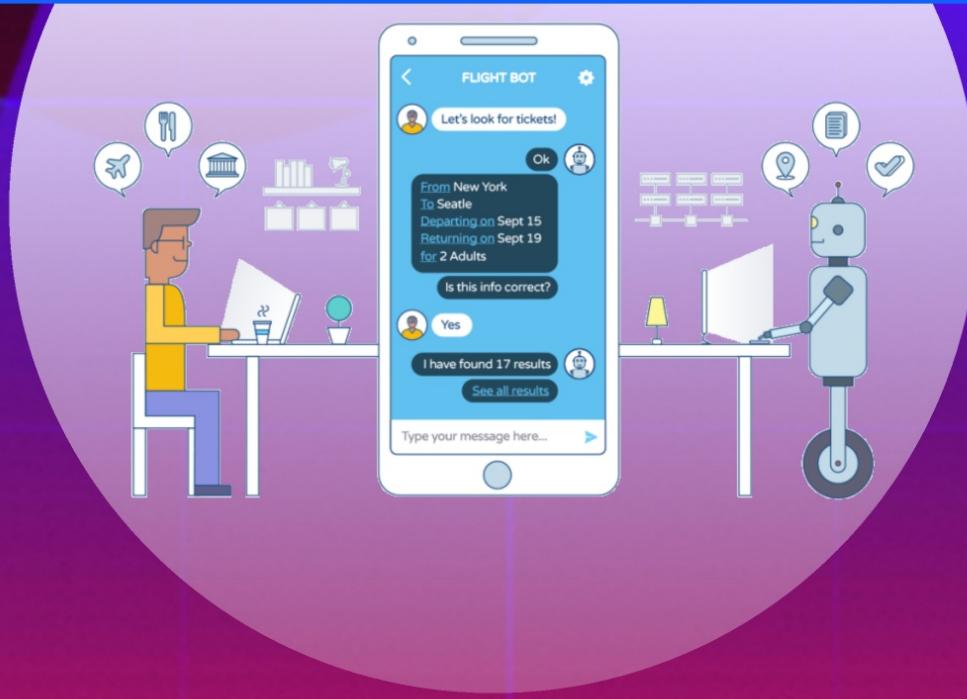
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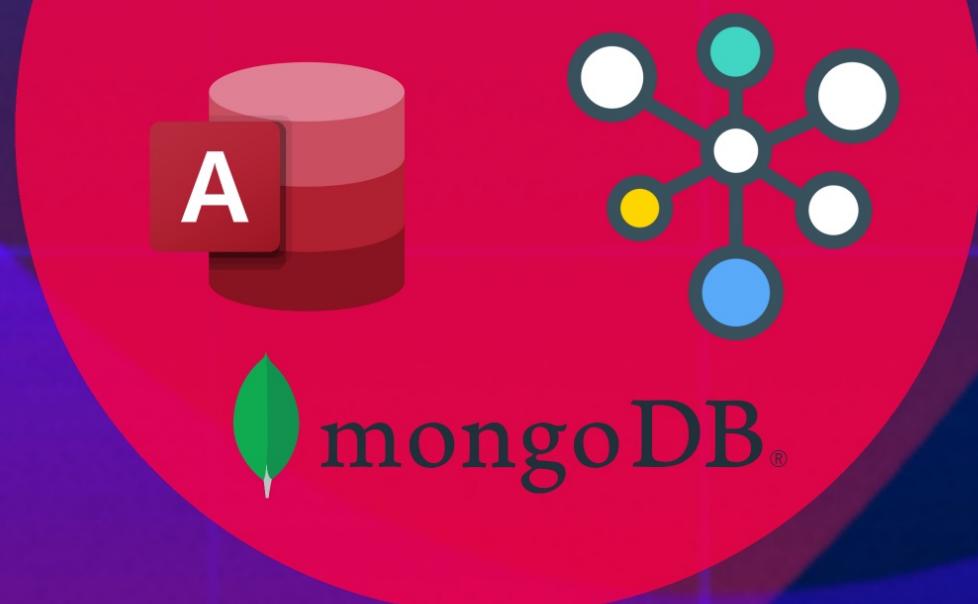
Why DBs?

Types of DBs

Why DataBases?



Types of DBs



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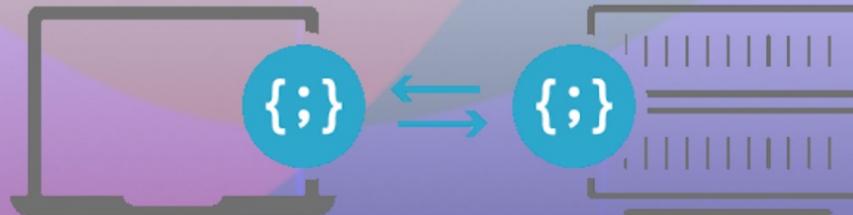
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JavaScript

PHP & MySQL

MySQL

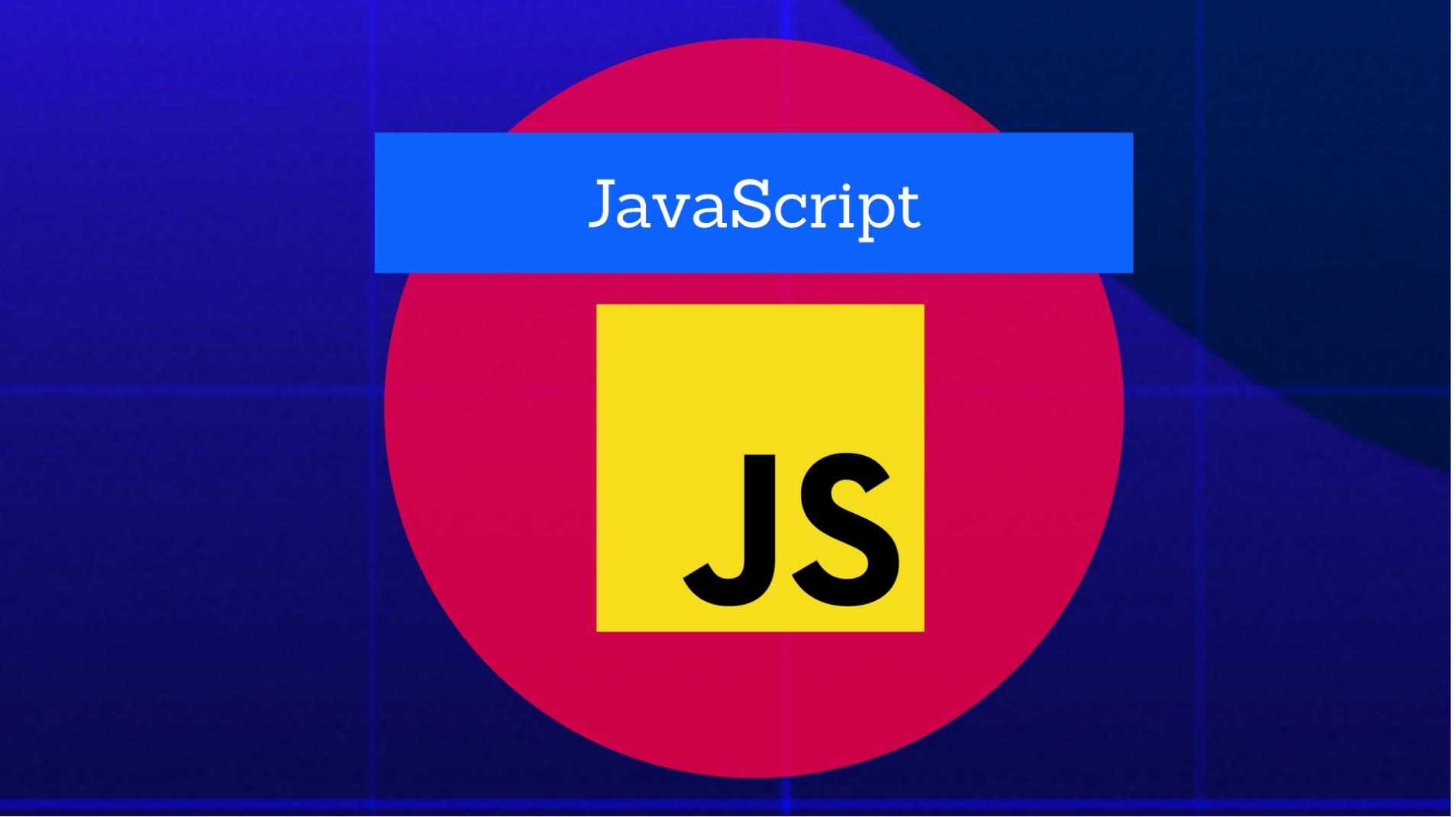
HTML and CSS

HTML



CSS





JavaScript

JS

PHP & MD5

php



MySQL

MySQL®



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