Week 1 - Introduction

- **Section 1 Module Overview**
  - Introduce the motivation for utilizing AI and ML, and applications of it.
- **Section 2 Essential Mathematical Background**
  - **Special mathematical notation: special sets**

Symbol	Meaning
$\mathbb{R}$, ***R***	Set of all **real (continuous)** numbers
$\mathbb{N}$, ***N***	Set of all **natural** numbers not including zero
$\mathbb{Z}$, ***Z***	Set of all **integer** numbers
$\mathbb{Q}$, ***Q***	Set of all **fractional** (**rational**) numbers
$\mathbb{C}$, ***C***	Set of all **complex** numbers

  - **Special mathematical notation: logical statements**

Symbol	Meaning
¬	logical **"not"** statement
$\wedge$	logical **"and"** statement, e.g. $(x=3) \wedge (y=2)$, "x is 3 and y is 2"
$\vee$	logical **"or"** statement, e.g. $(x=3) \vee (x=-3)$ "x is 3 or -3"
$\in$	**is an element of** e.g. $-3 \in \mathbb{Z}$
$\Rightarrow$	logical **"if ... then"** statement, e.g. $P \Rightarrow Q$, "P implies Q"
$\Leftrightarrow$	logical **"if and only if"** statement, "iff" e.g. $P \Leftrightarrow Q$, "P if and only if Q"
$\exists$	**"there exists"** quantifier
$\forall$	**"for all"** quantifier

  - **Special mathematical notation: set operations**

Symbol	Meaning
⌀	the **empty** set, a set with no elements
∪	**union** of two sets e.g. {5,6} ∪ {-3,5} = {5,6,-3}
∩	**intersection** of two sets e.g. {5,6} ∩ {-3,5} = {5}
\	**subtract** from a set e.g. {5,6,-3}\{5,-3} = {6}
⊂	**subset** or is **contained** in a set, {5,-3} ⊂ ***Z*** is true, 5 and -3 are integer

- **Standard mathematical relations**

Symbol	Meaning
=	**equal to**
<	**less than**
>	**greater than**
≤	**less than or equal to**
≥	**greater than or equal to**
≫	**much greater than**
≪	**much less than**
≈	**approximately equal to**
≠	**not equal to**

- **Function composition, conditionals**
  - Functions can be **composed** by putting the output of one function into the input of another, so
    g(*f*(*x*)) means first put *x* into

    f, then put the result into *g*
  - **Example**: $g(x) = 10x$ and $f(x) = x^2$, then $f(g(x)) = (10x)^2 = 100x^2$
- **Summation and products**

$$\sum_{n=3}^{15} X_n = X_3 + X_4 + \cdots + X_{14} + X_{15}$$

$$\prod_{n=3}^{15} X_n = X_3 * X_4 * \cdots * X_{14} * X_{15}$$

- Future reading
  - **1 The Basics**
  - **2 Analytic Geometry**
  - **3 Linear Algebra: Vectors, Matrices, and Operations**