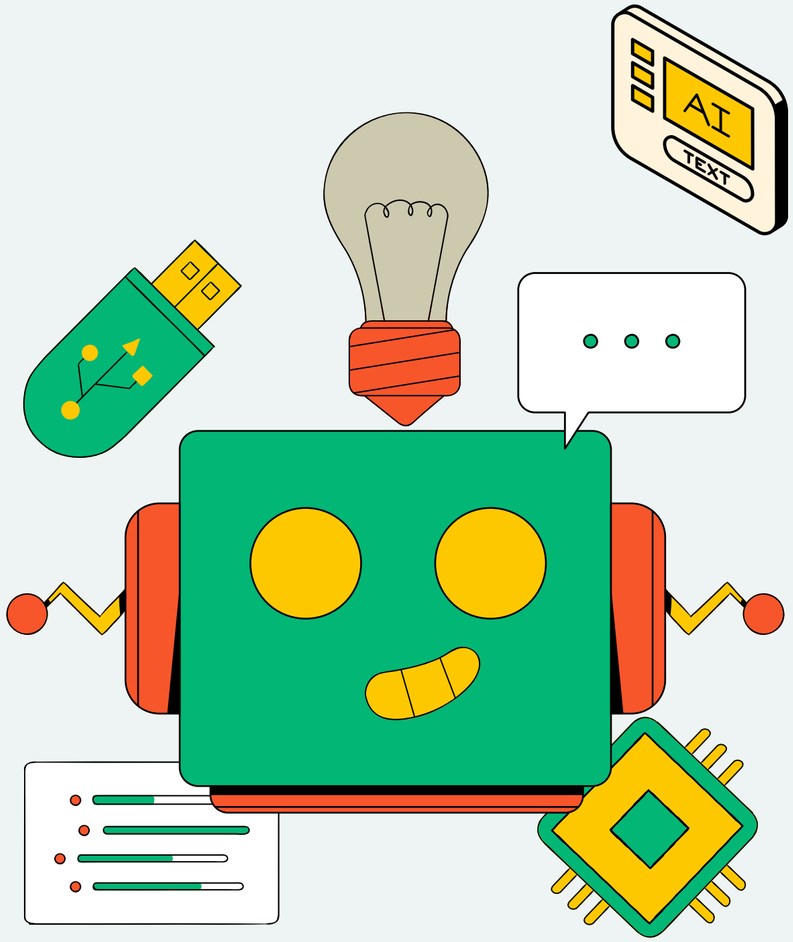
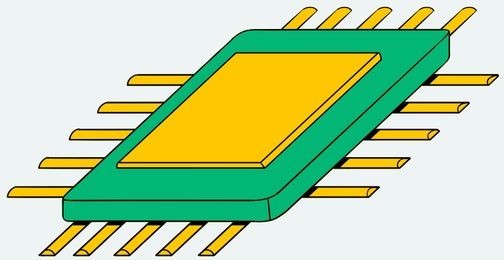


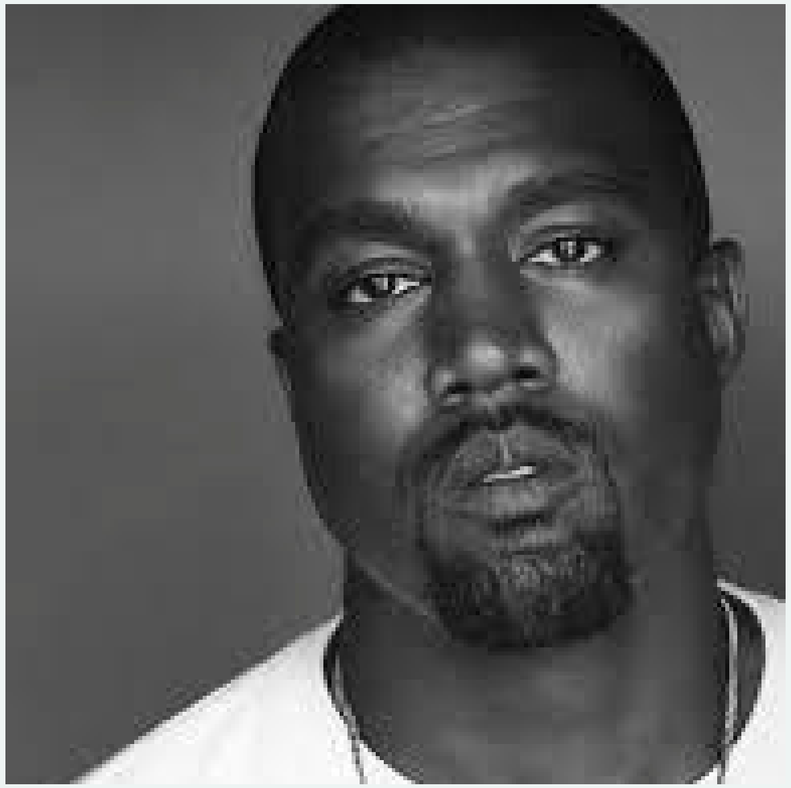
THE PHILOSOPHY OF “LEARNING”

(DEBUNKING THE BUZZWORDS)

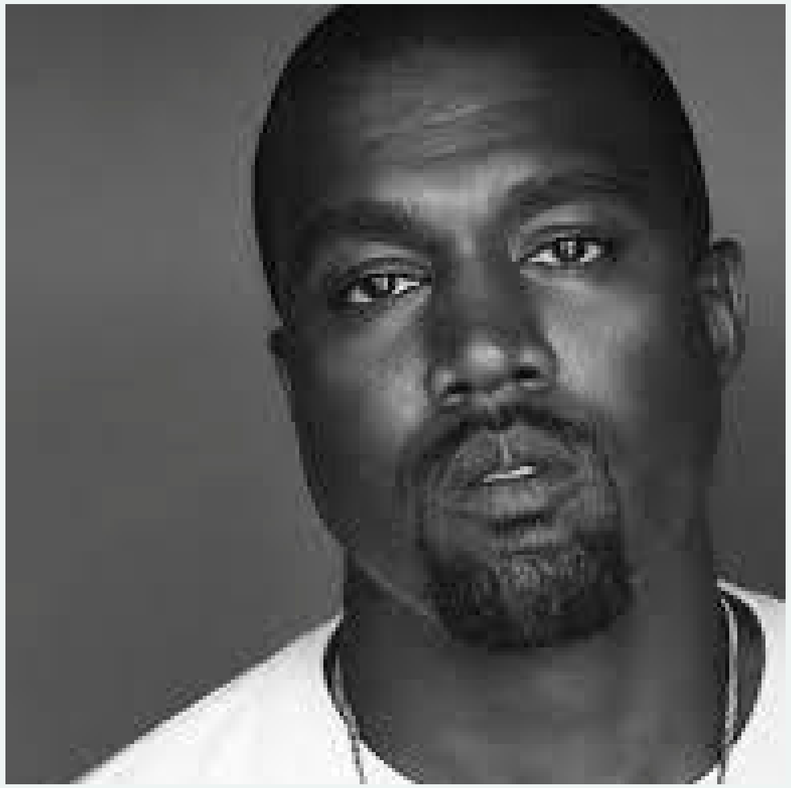
PARAM SHAH



RECOGNISE THEM?

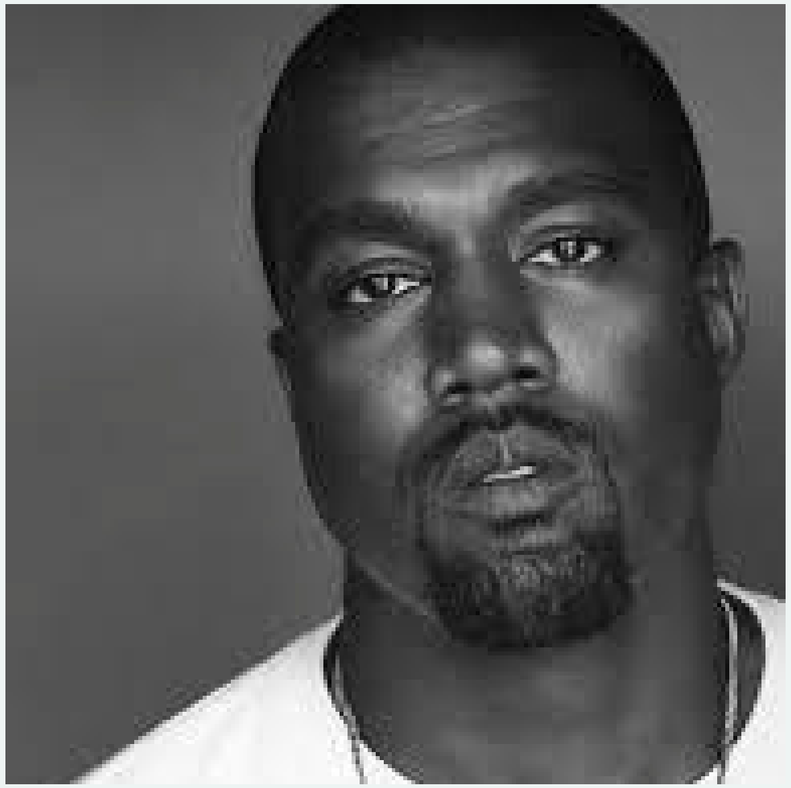


RECOGNISE THEM?



KANYE

RECOGNISE THEM?



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 [0.52 0.55 0.57 0.6  0.61 0.62 0.64 0.64 0.65 0.31 0.3  0.23 0.15 0.06 0.15 0.66 0.71 0.69 0.69 0.69 0.69 0.68 0.68 0.67 0.64 0.63 0.62 0.6  0.58 0.55]
 [0.55 0.57 0.59 0.61 0.63 0.64 0.65 0.51 0.07 0.08 0.07 0.22 0.16 0.2  0.05 0.09 0.64 0.7  0.71 0.71 0.71 0.7  0.69 0.69 0.67 0.65 0.64 0.62 0.6  0.58]
 [0.58 0.6  0.62 0.63 0.65 0.68 0.25 0.04 0.04 0.08 0.15 0.1  0.42 0.22 0.12 0.06 0.09 0.42 0.71 0.72 0.72 0.72 0.71 0.7  0.7  0.68 0.66 0.65 0.62 0.59]
 [0.58 0.61 0.64 0.66 0.67 0.6  0.05 0.06 0.13 0.24 0.31 0.35 0.33 0.29 0.22 0.02 0.04 0.14 0.72 0.72 0.73 0.73 0.73 0.72 0.71 0.7  0.68 0.66 0.64 0.64]
 [0.64 0.64 0.65 0.68 0.69 0.24 0.19 0.3  0.42 0.51 0.3  0.42 0.33 0.19 0.25 0.18 0.09 0.07 0.49 0.71 0.74 0.74 0.73 0.72 0.71 0.73 0.7  0.69 0.81 0.81]
 [0.76 0.65 0.67 0.71 0.71 0.39 0.42 0.49 0.42 0.3  0.25 0.39 0.33 0.21 0.17 0.11 0.07 0.02 0.07 0.76 0.74 0.74 0.74 0.73 0.73 0.78 0.88 0.71 0.67 0.67]
 [0.83 0.67 0.69 0.71 0.62 0.48 0.23 0.3  0.37 0.47 0.28 0.26 0.17 0.16 0.16 0.12 0.19 0.05 0.08 0.73 0.75 0.75 0.75 0.75 0.89 0.77 0.87 0.71 0.69 0.67]
 [0.79 0.69 0.7  0.71 0.64 0.35 0.16 0.39 0.44 0.59 0.2  0.04 0.04 0.03 0.2  0.2  0.19 0.04 0.34 0.11 0.75 0.75 0.75 0.74 0.92 0.75 0.95 0.72 0.7  0.68]
 [0.71 0.76 0.71 0.72 0.71 0.23 0.26 0.27 0.66 0.71 0.24 0.4  0.42 0.4  0.63 0.39 0.24 0.22 0.13 0.31 0.76 0.76 0.75 0.75 0.93 0.72 0.93 0.89 0.7  0.7 ]
 [0.67 0.84 0.72 0.73 0.73 0.29 0.04 0.25 0.1  0.75 0.45 0.78 0.81 0.74 0.56 0.31 0.2  0.1  0.23 0.31 0.74 0.76 0.75 0.75 0.84 0.75 0.79 0.94 0.95 0.83]
 [0.69 0.86 0.72 0.74 0.75 0.36 0.35 0.56 0.8  0.7  0.33 0.71 0.81 0.63 0.41 0.25 0.15 0.1  0.38 0.24 0.73 0.76 0.76 0.77 0.74 0.89 0.73 0.96 0.85 0.69]
 [0.68 0.82 0.73 0.74 0.76 0.73 0.56 0.82 0.85 0.5  0.17 0.35 0.69 0.51 0.35 0.26 0.19 0.15 0.18 0.56 0.75 0.76 0.76 0.76 0.76 0.91 0.75 0.92 0.82 0.83]
 [0.69 0.76 0.78 0.74 0.75 0.75 0.49 0.75 0.8  0.55 0.64 0.67 0.62 0.47 0.37 0.31 0.23 0.16 0.13 0.44 0.77 0.77 0.76 0.76 0.76 0.75 0.85 0.84 0.74 0.71]
 [0.7  0.73 0.85 0.73 0.76 0.77 0.7  0.71 0.75 0.78 0.21 0.05 0.05 0.48 0.37 0.32 0.2  0.16 0.2  0.27 0.76 0.77 0.76 0.76 0.76 0.76 0.73 0.74 0.77 0.91]
 [0.69 0.72 0.88 0.75 0.76 0.76 0.73 0.75 0.7  0.24 0.65 0.29 0.18 0.51 0.34 0.29 0.15 0.2  0.17 0.24 0.69 0.75 0.76 0.76 0.79 0.83 0.92 0.76 0.93 0.91]
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 [0.69 0.71 0.75 0.82 0.75 0.75 0.76 0.77 0.77 0.77 0.63 0.48 0.19 0.2  0.09 0.05 0.03 0.11 0.36 0.22 0.32 0.66 0.78 0.78 0.76 0.75 0.75 0.75 0.73 0.71]
 [0.68 0.7  0.71 0.89 0.75 0.75 0.76 0.77 0.77 0.79 0.77 0.75 0.42 0.13 0.12 0.09 0.07 0.35 0.4  0.12 0.22 0.35 0.77 0.76 0.76 0.75 0.75 0.75 0.73 0.71]
 [0.67 0.7  0.72 0.86 0.75 0.75 0.76 0.76 0.77 0.77 0.77 0.78 0.64 0.3  0.31 0.32 0.27 0.38 0.49 0.24 0.53 0.57 0.5  0.7  0.79 0.74 0.72 0.71 0.69 0.68]
 [0.66 0.69 0.71 0.83 0.74 0.75 0.75 0.76 0.76 0.77 0.77 0.77 0.68 0.52 0.46 0.51 0.53 0.67 0.46 0.47 0.75 0.67 0.28 0.06 0.07 0.34 0.63 0.64 0.63 0.63]
 [0.64 0.67 0.69 0.76 0.78 0.74 0.75 0.75 0.76 0.76 0.77 0.77 0.76 0.64 0.53 0.72 0.75 0.79 0.25 0.73 0.61 0.45 0.64 0.58 0.49 0.33 0.21 0.53 0.55 0.56]
 [0.64 0.66 0.69 0.71 0.82 0.73 0.74 0.75 0.75 0.76 0.76 0.76 0.76 0.76 0.64 0.77 0.78 0.2  0.71 0.31 0.33 0.71 0.71 0.64 0.54 0.47 0.31 0.24 0.51 0.5 ]
 [0.62 0.64 0.67 0.69 0.85 0.73 0.73 0.74 0.74 0.75 0.75 0.75 0.75 0.78 0.81 0.76 0.72 0.32 0.53 0.32 0.64 0.72 0.79 0.75 0.67 0.59 0.47 0.37 0.23 0.43]
 [0.6  0.63 0.65 0.68 0.83 0.71 0.72 0.73 0.73 0.73 0.73 0.73 0.72 0.75 0.84 0.01 0.09 0.2  0.58 0.07 0.7  0.75 0.79 0.75 0.73 0.67 0.6  0.47 0.34 0.2 ]
 [0.58 0.61 0.64 0.65 0.76 0.72 0.7  0.71 0.72 0.72 0.72 0.73 0.73 0.72 0.08 0.11 0.06 0.02 0.05 0.66 0.64 0.7  0.71 0.71 0.71 0.7  0.65 0.57 0.42 0.29]
 [0.56 0.59 0.62 0.64 0.69 0.75 0.68 0.69 0.7  0.7  0.7  0.7  0.6  0.06 0.07 0.09 0.07 0.02 0.02 0.65 0.68 0.68 0.64 0.67 0.67 0.66 0.64 0.6  0.5  0.37]
 [0.54 0.56 0.59 0.61 0.63 0.79 0.66 0.67 0.68 0.67 0.68 0.68 0.08 0.07 0.09 0.07 0.03 0.05 0.1  0.69 0.69 0.67 0.65 0.62 0.58 0.58 0.62 0.58 0.53 0.45]
 [0.51 0.54 0.56 0.58 0.61 0.79 0.64 0.65 0.65 0.65 0.64 0.27 0.06 0.05 0.07 0.   0.05 0.04 0.29 0.67 0.69 0.65 0.64 0.56 0.5  0.52 0.52 0.55 0.51 0.45]]
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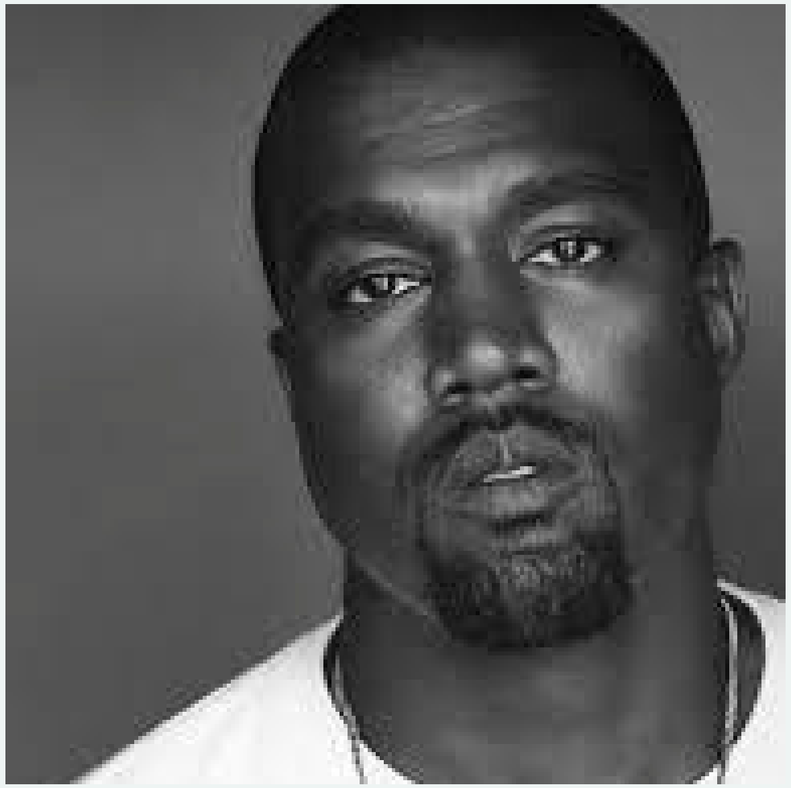
KANYE

RECOGNISE THEM?



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 [0.55 0.57 0.59 0.61 0.63 0.64 0.65 0.51 0.07 0.08 0.07 0.22 0.16 0.2  0.05 0.09 0.64 0.7  0.71 0.71 0.71 0.7  0.69 0.69 0.67 0.65 0.64 0.62 0.6  0.58]
 [0.58 0.6  0.62 0.63 0.65 0.68 0.25 0.04 0.04 0.08 0.15 0.1  0.42 0.22 0.12 0.06 0.09 0.42 0.71 0.72 0.72 0.72 0.71 0.7  0.7  0.68 0.66 0.65 0.62 0.59]
 [0.58 0.61 0.64 0.66 0.67 0.6  0.05 0.06 0.13 0.24 0.31 0.35 0.33 0.29 0.22 0.02 0.04 0.14 0.72 0.72 0.73 0.73 0.73 0.72 0.71 0.7  0.68 0.66 0.64 0.64]
 [0.64 0.64 0.65 0.68 0.69 0.24 0.19 0.3  0.42 0.51 0.3  0.42 0.33 0.19 0.25 0.18 0.09 0.07 0.49 0.71 0.74 0.74 0.73 0.72 0.71 0.73 0.7  0.69 0.81 0.81]
 [0.76 0.65 0.67 0.71 0.71 0.39 0.42 0.49 0.42 0.3  0.25 0.39 0.33 0.21 0.17 0.11 0.07 0.02 0.07 0.76 0.74 0.74 0.74 0.73 0.73 0.78 0.88 0.71 0.67 0.67]
 [0.83 0.67 0.69 0.71 0.62 0.48 0.23 0.3  0.37 0.47 0.28 0.26 0.17 0.16 0.16 0.12 0.19 0.05 0.08 0.73 0.75 0.75 0.75 0.75 0.89 0.77 0.87 0.71 0.69 0.67]
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 [0.67 0.84 0.72 0.73 0.73 0.29 0.04 0.25 0.1  0.75 0.45 0.78 0.81 0.74 0.56 0.31 0.2  0.1  0.23 0.31 0.74 0.76 0.75 0.75 0.84 0.75 0.79 0.94 0.95 0.83]
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 [0.69 0.71 0.75 0.82 0.75 0.75 0.76 0.77 0.77 0.77 0.63 0.48 0.19 0.2  0.09 0.05 0.03 0.11 0.36 0.22 0.32 0.66 0.78 0.78 0.76 0.75 0.75 0.75 0.73 0.71]
 [0.68 0.7  0.71 0.89 0.75 0.75 0.76 0.77 0.77 0.79 0.77 0.75 0.42 0.13 0.12 0.09 0.07 0.35 0.4  0.12 0.22 0.35 0.77 0.76 0.76 0.75 0.75 0.75 0.73 0.71]
 [0.67 0.7  0.72 0.86 0.75 0.75 0.76 0.76 0.77 0.77 0.77 0.78 0.64 0.3  0.31 0.32 0.27 0.38 0.49 0.24 0.53 0.57 0.5  0.7  0.79 0.74 0.72 0.71 0.69 0.68]
 [0.66 0.69 0.71 0.83 0.74 0.75 0.75 0.76 0.76 0.77 0.77 0.77 0.68 0.52 0.46 0.51 0.53 0.67 0.46 0.47 0.75 0.67 0.28 0.06 0.07 0.34 0.63 0.64 0.63 0.63]
 [0.64 0.67 0.69 0.76 0.78 0.74 0.75 0.75 0.76 0.76 0.77 0.77 0.76 0.64 0.53 0.72 0.75 0.79 0.25 0.73 0.61 0.45 0.64 0.58 0.49 0.33 0.21 0.53 0.55 0.56]
 [0.64 0.66 0.69 0.71 0.82 0.73 0.74 0.75 0.75 0.76 0.76 0.76 0.76 0.76 0.64 0.77 0.78 0.2  0.71 0.31 0.33 0.71 0.71 0.64 0.54 0.47 0.31 0.24 0.51 0.5 ]
 [0.62 0.64 0.67 0.69 0.85 0.73 0.73 0.74 0.74 0.75 0.75 0.75 0.75 0.78 0.81 0.76 0.72 0.32 0.53 0.32 0.64 0.72 0.79 0.75 0.67 0.59 0.47 0.37 0.23 0.43]
 [0.6  0.63 0.65 0.68 0.83 0.71 0.72 0.73 0.73 0.73 0.73 0.73 0.72 0.75 0.84 0.01 0.09 0.2  0.58 0.07 0.7  0.75 0.79 0.75 0.73 0.67 0.6  0.47 0.34 0.2 ]
 [0.58 0.61 0.64 0.65 0.76 0.72 0.7  0.71 0.72 0.72 0.72 0.73 0.73 0.72 0.08 0.11 0.06 0.02 0.05 0.66 0.64 0.7  0.71 0.71 0.71 0.7  0.65 0.57 0.42 0.29]
 [0.56 0.59 0.62 0.64 0.69 0.75 0.68 0.69 0.7  0.7  0.7  0.7  0.6  0.06 0.07 0.09 0.07 0.02 0.02 0.65 0.68 0.68 0.64 0.67 0.67 0.66 0.64 0.6  0.5  0.37]
 [0.54 0.56 0.59 0.61 0.63 0.79 0.66 0.67 0.68 0.67 0.68 0.68 0.08 0.07 0.09 0.07 0.03 0.05 0.1  0.69 0.69 0.67 0.65 0.62 0.58 0.58 0.62 0.58 0.53 0.45]
 [0.51 0.54 0.56 0.58 0.61 0.79 0.64 0.65 0.65 0.65 0.64 0.27 0.06 0.05 0.07 0.   0.05 0.04 0.29 0.67 0.69 0.65 0.64 0.56 0.5  0.52 0.52 0.55 0.51 0.45]]
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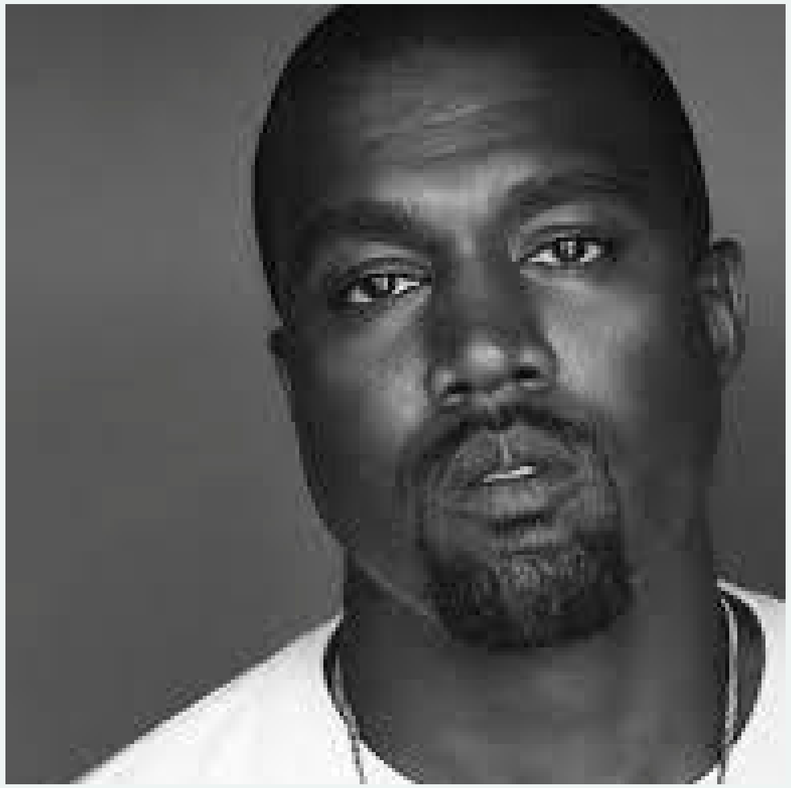
KANYE

(WHAT A COMPUTER SEES)

RECOGNISE THEM?



KANYE

(WHAT YOU SEE)

EVERYBODY WANTED TO KNOW...

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[[0.49 0.52 0.54 0.57 0.58 0.6  0.61 0.62 0.64 0.64 0.77 0.62 0.67 0.62 0.68 0.67 0.67 0.67 0.67 0.67 0.66 0.65 0.65 0.64 0.62 0.61 0.6  0.57 0.55 0.52]
 [0.52 0.55 0.57 0.6  0.61 0.62 0.64 0.64 0.65 0.31 0.3  0.23 0.15 0.06 0.15 0.66 0.71 0.69 0.69 0.69 0.69 0.68 0.68 0.67 0.64 0.63 0.62 0.6  0.58 0.55]
 [0.55 0.57 0.59 0.61 0.63 0.64 0.65 0.51 0.07 0.08 0.07 0.22 0.16 0.2  0.05 0.09 0.64 0.7  0.71 0.71 0.71 0.7  0.69 0.69 0.67 0.65 0.64 0.62 0.6  0.58]
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 [0.64 0.64 0.65 0.68 0.69 0.24 0.19 0.3  0.42 0.51 0.3  0.42 0.33 0.19 0.25 0.18 0.09 0.07 0.49 0.71 0.74 0.74 0.73 0.72 0.71 0.73 0.7  0.69 0.81 0.81]
 [0.76 0.65 0.67 0.71 0.71 0.39 0.42 0.49 0.42 0.3  0.25 0.39 0.33 0.21 0.17 0.11 0.07 0.02 0.07 0.76 0.74 0.74 0.74 0.73 0.73 0.78 0.88 0.71 0.67 0.67]
 [0.83 0.67 0.69 0.71 0.62 0.48 0.23 0.3  0.37 0.47 0.28 0.26 0.17 0.16 0.16 0.12 0.19 0.05 0.08 0.73 0.75 0.75 0.75 0.75 0.89 0.77 0.87 0.71 0.69 0.67]
 [0.79 0.69 0.7  0.71 0.64 0.35 0.16 0.39 0.44 0.59 0.2  0.04 0.04 0.03 0.2  0.2  0.19 0.04 0.34 0.11 0.75 0.75 0.75 0.74 0.92 0.75 0.95 0.72 0.7  0.68]
 [0.71 0.76 0.71 0.72 0.71 0.23 0.26 0.27 0.66 0.71 0.24 0.4  0.42 0.4  0.63 0.39 0.24 0.22 0.13 0.31 0.76 0.76 0.75 0.75 0.93 0.72 0.93 0.89 0.7  0.7 ]
 [0.67 0.84 0.72 0.73 0.73 0.29 0.04 0.25 0.1  0.75 0.45 0.78 0.81 0.74 0.56 0.31 0.2  0.1  0.23 0.31 0.74 0.76 0.75 0.75 0.84 0.75 0.79 0.94 0.95 0.83]
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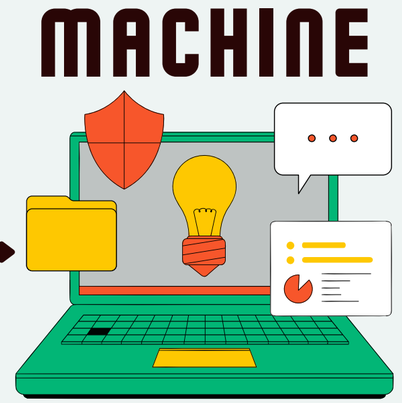
 [0.68 0.82 0.73 0.74 0.76 0.73 0.56 0.82 0.85 0.5  0.17 0.35 0.69 0.51 0.35 0.26 0.19 0.15 0.18 0.56 0.75 0.76 0.76 0.76 0.76 0.91 0.75 0.92 0.82 0.83]
 [0.69 0.76 0.78 0.74 0.75 0.75 0.49 0.75 0.8  0.55 0.64 0.67 0.62 0.47 0.37 0.31 0.23 0.16 0.13 0.44 0.77 0.77 0.76 0.76 0.76 0.75 0.85 0.84 0.74 0.71]
 [0.7  0.73 0.85 0.73 0.76 0.77 0.7  0.71 0.75 0.78 0.21 0.05 0.05 0.48 0.37 0.32 0.2  0.16 0.2  0.27 0.76 0.77 0.76 0.76 0.76 0.76 0.73 0.74 0.77 0.91]
 [0.69 0.72 0.88 0.75 0.76 0.76 0.73 0.75 0.7  0.24 0.65 0.29 0.18 0.51 0.34 0.29 0.15 0.2  0.17 0.24 0.69 0.75 0.76 0.76 0.79 0.83 0.92 0.76 0.93 0.91]
 [0.69 0.72 0.86 0.75 0.75 0.75 0.76 0.78 0.68 0.67 0.19 0.13 0.66 0.55 0.31 0.17 0.16 0.04 0.13 0.25 0.32 0.76 0.88 0.89 0.91 0.84 0.95 0.87 0.81 0.73]
 [0.69 0.71 0.81 0.78 0.75 0.76 0.76 0.76 0.77 0.66 0.76 0.82 0.68 0.27 0.13 0.15 0.07 0.04 0.15 0.2  0.05 0.75 0.75 0.95 0.84 0.87 0.75 0.73 0.73 0.71]
 [0.69 0.71 0.75 0.82 0.75 0.75 0.76 0.77 0.77 0.77 0.63 0.48 0.19 0.2  0.09 0.05 0.03 0.11 0.36 0.22 0.32 0.66 0.78 0.78 0.76 0.75 0.75 0.75 0.73 0.71]
 [0.68 0.7  0.71 0.89 0.75 0.75 0.76 0.77 0.77 0.79 0.77 0.75 0.42 0.13 0.12 0.09 0.07 0.35 0.4  0.12 0.22 0.35 0.77 0.76 0.76 0.75 0.75 0.75 0.73 0.71]
 [0.67 0.7  0.72 0.86 0.75 0.75 0.76 0.76 0.77 0.77 0.77 0.78 0.64 0.3  0.31 0.32 0.27 0.38 0.49 0.24 0.53 0.57 0.5  0.7  0.79 0.74 0.72 0.71 0.69 0.68]
 [0.66 0.69 0.71 0.83 0.74 0.75 0.75 0.76 0.76 0.77 0.77 0.77 0.68 0.52 0.46 0.51 0.53 0.67 0.46 0.47 0.75 0.67 0.28 0.06 0.07 0.34 0.63 0.64 0.63 0.63]
 [0.64 0.67 0.69 0.76 0.78 0.74 0.75 0.75 0.76 0.76 0.77 0.77 0.76 0.64 0.53 0.72 0.75 0.79 0.25 0.73 0.61 0.45 0.64 0.58 0.49 0.33 0.21 0.53 0.55 0.56]
 [0.64 0.66 0.69 0.71 0.82 0.73 0.74 0.75 0.75 0.76 0.76 0.76 0.76 0.76 0.64 0.77 0.78 0.2  0.71 0.31 0.33 0.71 0.71 0.64 0.54 0.47 0.31 0.24 0.51 0.5 ]
 [0.62 0.64 0.67 0.69 0.85 0.73 0.73 0.74 0.74 0.75 0.75 0.75 0.75 0.78 0.81 0.76 0.72 0.32 0.53 0.32 0.64 0.72 0.79 0.75 0.67 0.59 0.47 0.37 0.23 0.43]
 [0.6  0.63 0.65 0.68 0.83 0.71 0.72 0.73 0.73 0.73 0.73 0.73 0.72 0.75 0.84 0.01 0.09 0.2  0.58 0.07 0.7  0.75 0.79 0.75 0.73 0.67 0.6  0.47 0.34 0.2 ]
 [0.58 0.61 0.64 0.65 0.76 0.72 0.7  0.71 0.72 0.72 0.72 0.73 0.73 0.72 0.08 0.11 0.06 0.02 0.05 0.66 0.64 0.7  0.71 0.71 0.71 0.7  0.65 0.57 0.42 0.29]
 [0.56 0.59 0.62 0.64 0.69 0.75 0.68 0.69 0.7  0.7  0.7  0.7  0.6  0.06 0.07 0.09 0.07 0.02 0.02 0.65 0.68 0.68 0.64 0.67 0.67 0.66 0.64 0.6  0.5  0.37]
 [0.54 0.56 0.59 0.61 0.63 0.79 0.66 0.67 0.68 0.67 0.68 0.68 0.08 0.07 0.09 0.07 0.03 0.05 0.1  0.69 0.69 0.67 0.65 0.62 0.58 0.58 0.62 0.58 0.53 0.45]
 [0.51 0.54 0.56 0.58 0.61 0.79 0.64 0.65 0.65 0.65 0.64 0.27 0.06 0.05 0.07 0.   0.05 0.04 0.29 0.67 0.69 0.65 0.64 0.56 0.5  0.52 0.52 0.55 0.51 0.45]]
```

INPUT

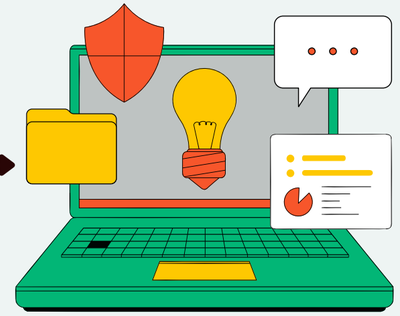


EVERYBODY WANTED TO KNOW...

```
[[0.49 0.52 0.54 0.57 0.58 0.6  0.61 0.62 0.64 0.64 0.77 0.62 0.67 0.62 0.68 0.67 0.67 0.67 0.67 0.67 0.66 0.65 0.65 0.64 0.62 0.61 0.6  0.57 0.55 0.52]
 [0.52 0.55 0.57 0.6  0.61 0.62 0.64 0.64 0.65 0.31 0.3  0.23 0.15 0.06 0.15 0.66 0.71 0.69 0.69 0.69 0.69 0.68 0.68 0.67 0.64 0.63 0.62 0.6  0.58 0.55]
 [0.55 0.57 0.59 0.61 0.63 0.64 0.65 0.51 0.07 0.08 0.07 0.22 0.16 0.2  0.05 0.09 0.64 0.7  0.71 0.71 0.71 0.7  0.69 0.69 0.67 0.65 0.64 0.62 0.6  0.58]
 [0.58 0.6  0.62 0.63 0.65 0.68 0.25 0.04 0.04 0.08 0.15 0.1  0.42 0.22 0.12 0.06 0.09 0.42 0.71 0.72 0.72 0.72 0.71 0.7  0.7  0.68 0.66 0.65 0.62 0.59]
 [0.58 0.61 0.64 0.66 0.67 0.6  0.05 0.06 0.13 0.24 0.31 0.35 0.33 0.29 0.22 0.02 0.04 0.14 0.72 0.72 0.73 0.73 0.73 0.72 0.71 0.7  0.68 0.66 0.64 0.64]
 [0.64 0.64 0.65 0.68 0.69 0.24 0.19 0.3  0.42 0.51 0.3  0.42 0.33 0.19 0.25 0.18 0.09 0.07 0.49 0.71 0.74 0.74 0.73 0.72 0.71 0.73 0.7  0.69 0.81 0.81]
 [0.76 0.65 0.67 0.71 0.71 0.39 0.42 0.49 0.42 0.3  0.25 0.39 0.33 0.21 0.17 0.11 0.07 0.02 0.07 0.76 0.74 0.74 0.74 0.73 0.73 0.78 0.88 0.71 0.67 0.67]
 [0.83 0.67 0.69 0.71 0.62 0.48 0.23 0.3  0.37 0.47 0.28 0.26 0.17 0.16 0.16 0.12 0.19 0.05 0.08 0.73 0.75 0.75 0.75 0.75 0.89 0.77 0.87 0.71 0.69 0.67]
 [0.79 0.69 0.7  0.71 0.64 0.35 0.16 0.39 0.44 0.59 0.2  0.04 0.04 0.03 0.2  0.2  0.19 0.04 0.34 0.11 0.75 0.75 0.75 0.74 0.92 0.75 0.95 0.72 0.7  0.68]
 [0.71 0.76 0.71 0.72 0.71 0.23 0.26 0.27 0.66 0.71 0.24 0.4  0.42 0.4  0.63 0.39 0.24 0.22 0.13 0.31 0.76 0.76 0.75 0.75 0.93 0.72 0.93 0.89 0.7  0.7 ]
 [0.67 0.84 0.72 0.73 0.73 0.29 0.04 0.25 0.1  0.75 0.45 0.78 0.81 0.74 0.56 0.31 0.2  0.1  0.23 0.31 0.74 0.76 0.75 0.75 0.84 0.75 0.79 0.94 0.95 0.83]
 [0.69 0.86 0.72 0.74 0.75 0.36 0.35 0.56 0.8  0.7  0.33 0.71 0.81 0.63 0.41 0.25 0.15 0.1  0.38 0.24 0.73 0.76 0.76 0.77 0.74 0.89 0.73 0.96 0.85 0.69]
 [0.68 0.82 0.73 0.74 0.76 0.73 0.56 0.82 0.85 0.5  0.17 0.35 0.69 0.51 0.35 0.26 0.19 0.15 0.18 0.56 0.75 0.76 0.76 0.76 0.76 0.91 0.75 0.92 0.82 0.83]
 [0.69 0.76 0.78 0.74 0.75 0.75 0.49 0.75 0.8  0.55 0.64 0.67 0.62 0.47 0.37 0.31 0.23 0.16 0.13 0.44 0.77 0.77 0.76 0.76 0.76 0.75 0.85 0.84 0.74 0.71]
 [0.7  0.73 0.85 0.73 0.76 0.77 0.7  0.71 0.75 0.78 0.21 0.05 0.05 0.48 0.37 0.32 0.2  0.16 0.2  0.27 0.76 0.77 0.76 0.76 0.76 0.76 0.73 0.74 0.77 0.91]
 [0.69 0.72 0.88 0.75 0.76 0.76 0.73 0.75 0.7  0.24 0.65 0.29 0.18 0.51 0.34 0.29 0.15 0.2  0.17 0.24 0.69 0.75 0.76 0.76 0.79 0.83 0.92 0.76 0.93 0.91]
 [0.69 0.72 0.86 0.75 0.75 0.75 0.76 0.78 0.68 0.67 0.19 0.13 0.66 0.55 0.31 0.17 0.16 0.04 0.13 0.25 0.32 0.76 0.88 0.89 0.91 0.84 0.95 0.87 0.81 0.73]
 [0.69 0.71 0.81 0.78 0.75 0.76 0.76 0.76 0.77 0.66 0.76 0.82 0.68 0.27 0.13 0.15 0.07 0.04 0.15 0.2  0.05 0.75 0.75 0.95 0.84 0.87 0.75 0.73 0.73 0.71]
 [0.69 0.71 0.75 0.82 0.75 0.75 0.76 0.77 0.77 0.77 0.63 0.48 0.19 0.2  0.09 0.05 0.03 0.11 0.36 0.22 0.32 0.66 0.78 0.78 0.76 0.75 0.75 0.75 0.73 0.71]
 [0.68 0.7  0.71 0.89 0.75 0.75 0.76 0.77 0.77 0.79 0.77 0.75 0.42 0.13 0.12 0.09 0.07 0.35 0.4  0.12 0.22 0.35 0.77 0.76 0.76 0.75 0.75 0.75 0.73 0.71]
 [0.67 0.7  0.72 0.86 0.75 0.75 0.76 0.76 0.77 0.77 0.77 0.78 0.64 0.3  0.31 0.32 0.27 0.38 0.49 0.24 0.53 0.57 0.5  0.7  0.79 0.74 0.72 0.71 0.69 0.68]
 [0.66 0.69 0.71 0.83 0.74 0.75 0.75 0.76 0.76 0.77 0.77 0.77 0.68 0.52 0.46 0.51 0.53 0.67 0.46 0.47 0.75 0.67 0.28 0.06 0.07 0.34 0.63 0.64 0.63 0.63]
 [0.64 0.67 0.69 0.76 0.78 0.74 0.75 0.75 0.76 0.76 0.77 0.77 0.76 0.64 0.53 0.72 0.75 0.79 0.25 0.73 0.61 0.45 0.64 0.58 0.49 0.33 0.21 0.53 0.55 0.56]
 [0.64 0.66 0.69 0.71 0.82 0.73 0.74 0.75 0.75 0.76 0.76 0.76 0.76 0.76 0.64 0.77 0.78 0.2  0.71 0.31 0.33 0.71 0.71 0.64 0.54 0.47 0.31 0.24 0.51 0.5 ]
 [0.62 0.64 0.67 0.69 0.85 0.73 0.73 0.74 0.74 0.75 0.75 0.75 0.75 0.78 0.81 0.76 0.72 0.32 0.53 0.32 0.64 0.72 0.79 0.75 0.67 0.59 0.47 0.37 0.23 0.43]
 [0.6  0.63 0.65 0.68 0.83 0.71 0.72 0.73 0.73 0.73 0.73 0.73 0.72 0.75 0.84 0.01 0.09 0.2  0.58 0.07 0.7  0.75 0.79 0.75 0.73 0.67 0.6  0.47 0.34 0.2 ]
 [0.58 0.61 0.64 0.65 0.76 0.72 0.7  0.71 0.72 0.72 0.72 0.73 0.73 0.72 0.08 0.11 0.06 0.02 0.05 0.66 0.64 0.7  0.71 0.71 0.71 0.7  0.65 0.57 0.42 0.29]
 [0.56 0.59 0.62 0.64 0.69 0.75 0.68 0.69 0.7  0.7  0.7  0.7  0.6  0.06 0.07 0.09 0.07 0.02 0.02 0.65 0.68 0.68 0.64 0.67 0.67 0.66 0.64 0.6  0.5  0.37]
 [0.54 0.56 0.59 0.61 0.63 0.79 0.66 0.67 0.68 0.67 0.68 0.68 0.08 0.07 0.09 0.07 0.03 0.05 0.1  0.69 0.69 0.67 0.65 0.62 0.58 0.58 0.62 0.58 0.53 0.45]
 [0.51 0.54 0.56 0.58 0.61 0.79 0.64 0.65 0.65 0.65 0.64 0.27 0.06 0.05 0.07 0.   0.05 0.04 0.29 0.67 0.69 0.65 0.64 0.56 0.5  0.52 0.52 0.55 0.51 0.45]]
```

INPUT

MACHINE



OUTPUT

TAYLOR SWIFT

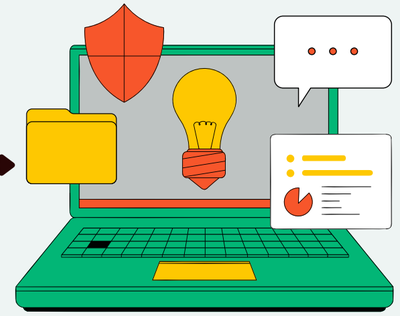
(AND NOT SOMEONE AS GREAT)

EVERYBODY WANTED TO KNOW...

```
[[0.49 0.52 0.54 0.57 0.58 0.6  0.61 0.62 0.64 0.64 0.77 0.62 0.67 0.62 0.68 0.67 0.67 0.67 0.67 0.67 0.66 0.65 0.65 0.64 0.62 0.61 0.6  0.57 0.55 0.52]
 [0.52 0.55 0.57 0.6  0.61 0.62 0.64 0.64 0.65 0.31 0.3  0.23 0.15 0.06 0.15 0.66 0.71 0.69 0.69 0.69 0.69 0.68 0.68 0.67 0.64 0.63 0.62 0.6  0.58 0.55]
 [0.55 0.57 0.59 0.61 0.63 0.64 0.65 0.51 0.07 0.08 0.07 0.22 0.16 0.2  0.05 0.09 0.64 0.7  0.71 0.71 0.71 0.7  0.69 0.69 0.67 0.65 0.64 0.62 0.6  0.58]
 [0.58 0.6  0.62 0.63 0.65 0.68 0.25 0.04 0.04 0.08 0.15 0.1  0.42 0.22 0.12 0.06 0.09 0.42 0.71 0.72 0.72 0.72 0.71 0.7  0.7  0.68 0.66 0.65 0.62 0.59]
 [0.58 0.61 0.64 0.66 0.67 0.6  0.05 0.06 0.13 0.24 0.31 0.35 0.33 0.29 0.22 0.02 0.04 0.14 0.72 0.72 0.73 0.73 0.73 0.72 0.71 0.7  0.68 0.66 0.64 0.64]
 [0.64 0.64 0.65 0.68 0.69 0.24 0.19 0.3  0.42 0.51 0.3  0.42 0.33 0.19 0.25 0.18 0.09 0.07 0.49 0.71 0.74 0.74 0.73 0.72 0.71 0.73 0.7  0.69 0.81 0.81]
 [0.76 0.65 0.67 0.71 0.71 0.39 0.42 0.49 0.42 0.3  0.25 0.39 0.33 0.21 0.17 0.11 0.07 0.02 0.07 0.76 0.74 0.74 0.74 0.73 0.73 0.78 0.88 0.71 0.67 0.67]
 [0.83 0.67 0.69 0.71 0.62 0.48 0.23 0.3  0.37 0.47 0.28 0.26 0.17 0.16 0.16 0.12 0.19 0.05 0.08 0.73 0.75 0.75 0.75 0.75 0.89 0.77 0.87 0.71 0.69 0.67]
 [0.79 0.69 0.7  0.71 0.64 0.35 0.16 0.39 0.44 0.59 0.2  0.04 0.04 0.03 0.2  0.2  0.19 0.04 0.34 0.11 0.75 0.75 0.75 0.74 0.92 0.75 0.95 0.72 0.7  0.68]
 [0.71 0.76 0.71 0.72 0.71 0.23 0.26 0.27 0.66 0.71 0.24 0.4  0.42 0.4  0.63 0.39 0.24 0.22 0.13 0.31 0.76 0.76 0.75 0.75 0.93 0.72 0.93 0.89 0.7  0.7 ]
 [0.67 0.84 0.72 0.73 0.73 0.29 0.04 0.25 0.1  0.75 0.45 0.78 0.81 0.74 0.56 0.31 0.2  0.1  0.23 0.31 0.74 0.76 0.75 0.75 0.84 0.75 0.79 0.94 0.95 0.83]
 [0.69 0.86 0.72 0.74 0.75 0.36 0.35 0.56 0.8  0.7  0.33 0.71 0.81 0.63 0.41 0.25 0.15 0.1  0.38 0.24 0.73 0.76 0.76 0.77 0.74 0.89 0.73 0.96 0.85 0.69]
 [0.68 0.82 0.73 0.74 0.76 0.73 0.56 0.82 0.85 0.5  0.17 0.35 0.69 0.51 0.35 0.26 0.19 0.15 0.18 0.56 0.75 0.76 0.76 0.76 0.76 0.91 0.75 0.92 0.82 0.83]
 [0.69 0.76 0.78 0.74 0.75 0.75 0.49 0.75 0.8  0.55 0.64 0.67 0.62 0.47 0.37 0.31 0.23 0.16 0.13 0.44 0.77 0.77 0.76 0.76 0.76 0.75 0.85 0.84 0.74 0.71]
 [0.7  0.73 0.85 0.73 0.76 0.77 0.7  0.71 0.75 0.78 0.21 0.05 0.05 0.48 0.37 0.32 0.2  0.16 0.2  0.27 0.76 0.77 0.76 0.76 0.76 0.76 0.73 0.74 0.77 0.91]
 [0.69 0.72 0.88 0.75 0.76 0.76 0.73 0.75 0.7  0.24 0.65 0.29 0.18 0.51 0.34 0.29 0.15 0.2  0.17 0.24 0.69 0.75 0.76 0.76 0.79 0.83 0.92 0.76 0.93 0.91]
 [0.69 0.72 0.86 0.75 0.75 0.75 0.76 0.78 0.68 0.67 0.19 0.13 0.66 0.55 0.31 0.17 0.16 0.04 0.13 0.25 0.32 0.76 0.88 0.89 0.91 0.84 0.95 0.87 0.81 0.73]
 [0.69 0.71 0.81 0.78 0.75 0.76 0.76 0.76 0.77 0.66 0.76 0.82 0.68 0.27 0.13 0.15 0.07 0.04 0.15 0.2  0.05 0.75 0.75 0.95 0.84 0.87 0.75 0.73 0.73 0.71]
 [0.69 0.71 0.75 0.82 0.75 0.75 0.76 0.77 0.77 0.77 0.63 0.48 0.19 0.2  0.09 0.05 0.03 0.11 0.36 0.22 0.32 0.66 0.78 0.78 0.76 0.75 0.75 0.75 0.73 0.71]
 [0.68 0.7  0.71 0.89 0.75 0.75 0.76 0.77 0.77 0.79 0.77 0.75 0.42 0.13 0.12 0.09 0.07 0.35 0.4  0.12 0.22 0.35 0.77 0.76 0.76 0.75 0.75 0.75 0.73 0.71]
 [0.67 0.7  0.72 0.86 0.75 0.75 0.76 0.76 0.77 0.77 0.77 0.78 0.64 0.3  0.31 0.32 0.27 0.38 0.49 0.24 0.53 0.57 0.5  0.7  0.79 0.74 0.72 0.71 0.69 0.68]
 [0.66 0.69 0.71 0.83 0.74 0.75 0.75 0.76 0.76 0.77 0.77 0.77 0.68 0.52 0.46 0.51 0.53 0.67 0.46 0.47 0.75 0.67 0.28 0.06 0.07 0.34 0.63 0.64 0.63 0.63]
 [0.64 0.67 0.69 0.76 0.78 0.74 0.75 0.75 0.76 0.76 0.77 0.77 0.76 0.64 0.53 0.72 0.75 0.79 0.25 0.73 0.61 0.45 0.64 0.58 0.49 0.33 0.21 0.53 0.55 0.56]
 [0.64 0.66 0.69 0.71 0.82 0.73 0.74 0.75 0.75 0.76 0.76 0.76 0.76 0.76 0.64 0.77 0.78 0.2  0.71 0.31 0.33 0.71 0.71 0.64 0.54 0.47 0.31 0.24 0.51 0.5 ]
 [0.62 0.64 0.67 0.69 0.85 0.73 0.73 0.74 0.74 0.75 0.75 0.75 0.75 0.78 0.81 0.76 0.72 0.32 0.53 0.32 0.64 0.72 0.79 0.75 0.67 0.59 0.47 0.37 0.23 0.43]
 [0.6  0.63 0.65 0.68 0.83 0.71 0.72 0.73 0.73 0.73 0.73 0.73 0.72 0.75 0.84 0.01 0.09 0.2  0.58 0.07 0.7  0.75 0.79 0.75 0.73 0.67 0.6  0.47 0.34 0.2 ]
 [0.58 0.61 0.64 0.65 0.76 0.72 0.7  0.71 0.72 0.72 0.72 0.73 0.73 0.72 0.08 0.11 0.06 0.02 0.05 0.66 0.64 0.7  0.71 0.71 0.71 0.7  0.65 0.57 0.42 0.29]
 [0.56 0.59 0.62 0.64 0.69 0.75 0.68 0.69 0.7  0.7  0.7  0.7  0.6  0.06 0.07 0.09 0.07 0.02 0.02 0.65 0.68 0.68 0.64 0.67 0.67 0.66 0.64 0.6  0.5  0.37]
 [0.54 0.56 0.59 0.61 0.63 0.79 0.66 0.67 0.68 0.67 0.68 0.68 0.08 0.07 0.09 0.07 0.03 0.05 0.1  0.69 0.69 0.67 0.65 0.62 0.58 0.58 0.62 0.58 0.53 0.45]
 [0.51 0.54 0.56 0.58 0.61 0.79 0.64 0.65 0.65 0.65 0.64 0.27 0.06 0.05 0.07 0.   0.05 0.04 0.29 0.67 0.69 0.65 0.64 0.56 0.5  0.52 0.52 0.55 0.51 0.45]]
```

INPUT

MACHINE



OUTPUT

TAYLOR SWIFT

(AND NOT SOMEONE AS GREAT)

GUESS WE WILL KNOW!

LET US “LEARN”!

Input (x)	Output (y)
2	4
3	9
4	16
7	?

LET US “LEARN”!

Input (x)	Output (y)
2	4
3	9
4	16
7	**49 :)**

LET US "LEARN"!

Input (x)	Output (y)
2	4
3	9
4	16
7	**49 :)**

$$y = f(x) = x^2$$

What is learning?

Learning….in a rather broad sense:

improvement of performance on the basis of experience

Machine learning……

- improve for task T
- with respect to performance measure P,
- based on experience E

What is learning?

Learning….in a rather broad sense:

improvement of performance on the basis of experience

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(IS THAT KANYE OR TAYLOR?)

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GIVEN DATA: INPUTS AND OUTPUTS
(SAMPLE IMAGES OF KANYE AND TAYLOR)

WHAT YOU ARE SUPPOSED TO DO.

01

CREATE AN ARCHITECTURE

- Know your task and observe the data given
- Assume a function (referred to as a model) with some params and hyper-params

02

DEFINE YOUR PERFORMANCE METRIC

- A “loss” function that makes the machine update its params (referred to as weights at times)

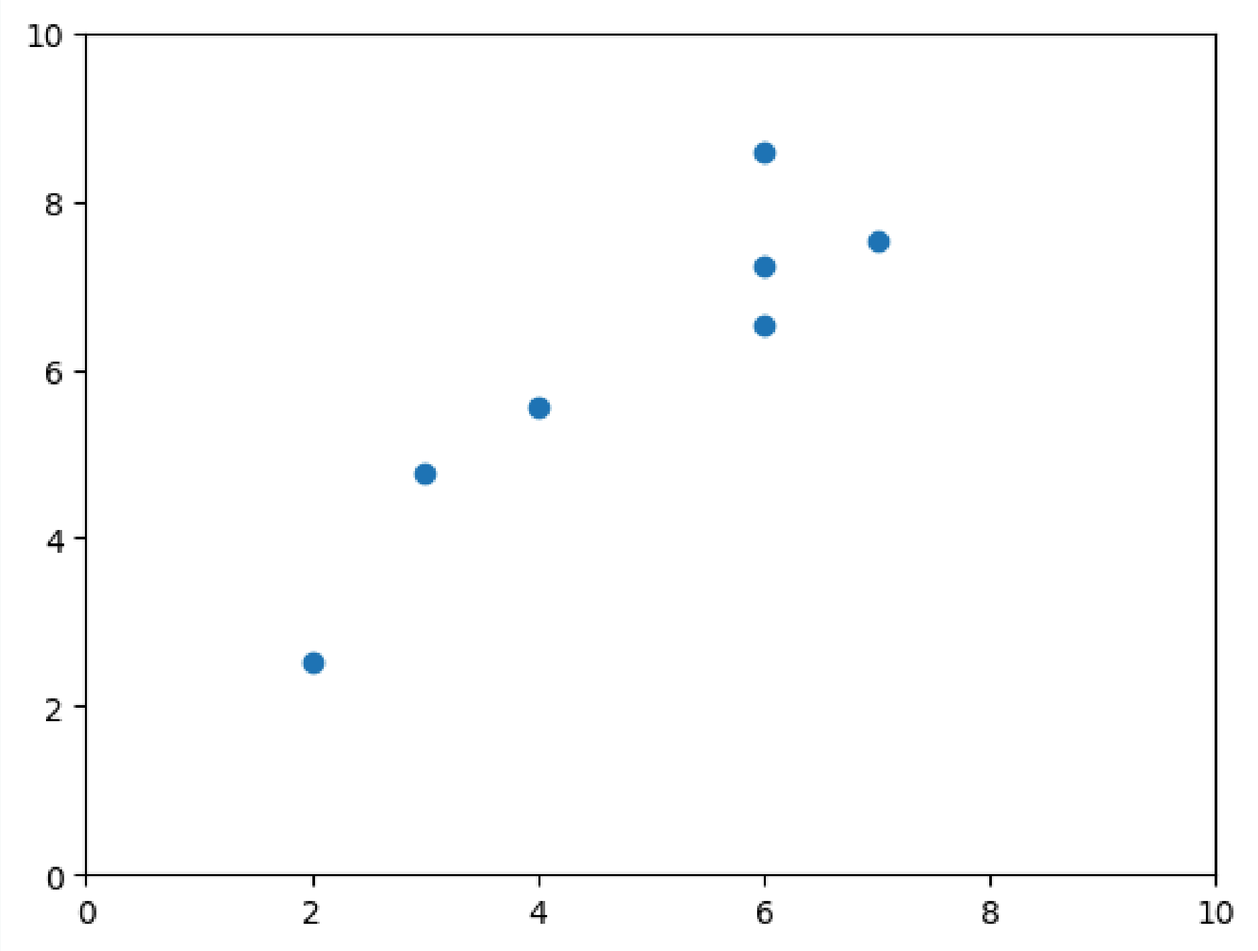
03

GUIDE THE MACHINE

- How to update the weights based on the loss function?
- Enjoy changing the hyper-params

EXAMPLES AVOID BLABBERING!

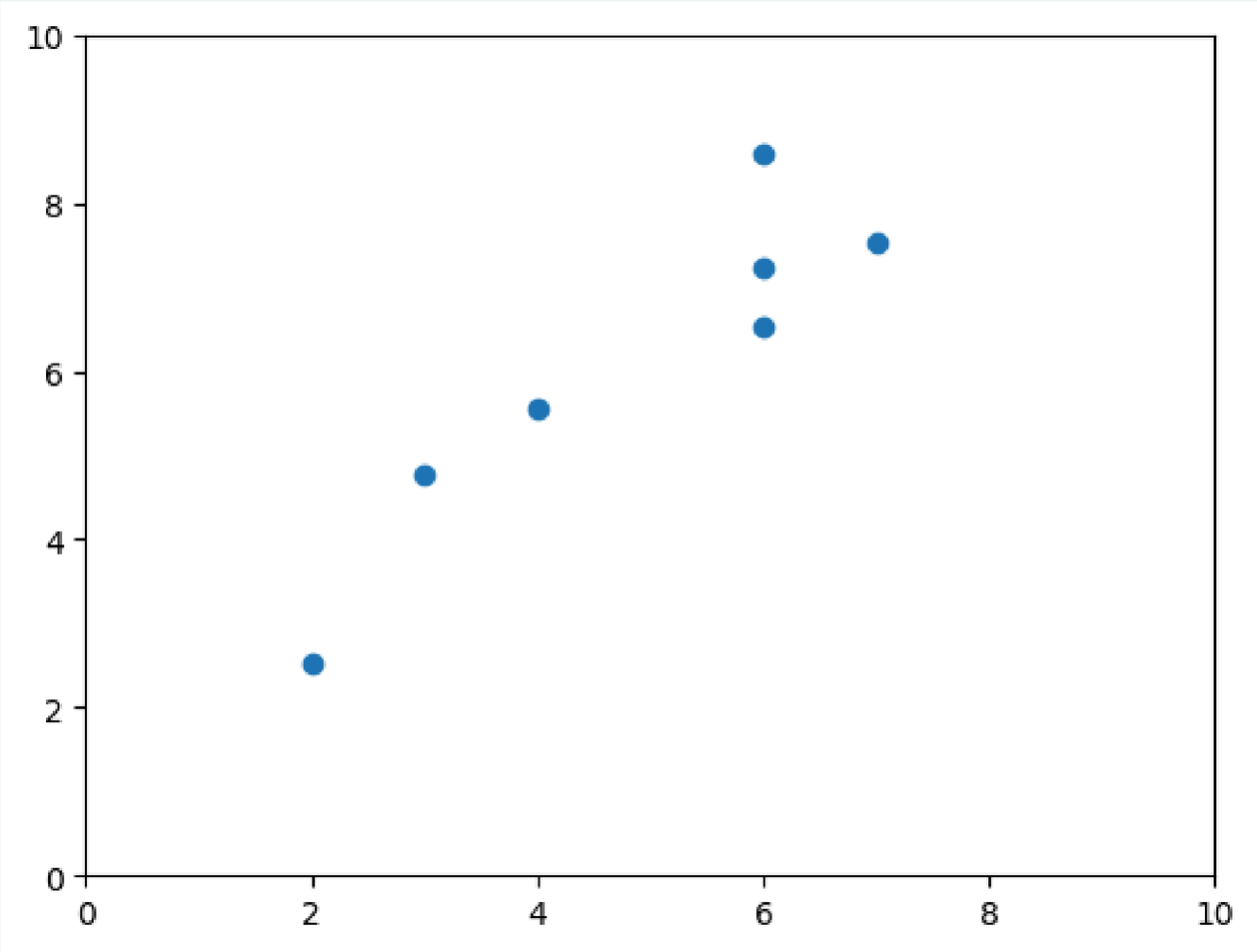
1 DIMENSIONAL INPUT (DIMENSIONS ARE ALSO CALLED FEATURES OF A DATA POINT)



1 DIMENSIONAL OUTPUT

$$\mathcal{D} = \{(\mathbf{x}_i, y_i)\}_{i=1}^{n}$$

EXAMPLES AVOID BLABBERING!



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$$y = h_{\mathbf{w}}(x) = w_0 + w_1 x$$

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$$\mathcal{D} = \{(\mathbf{x}_i, y_i)\}_{i=1}^{n} \qquad y = h_{\mathbf{w}}(x) = w_0 + w_1 x$$

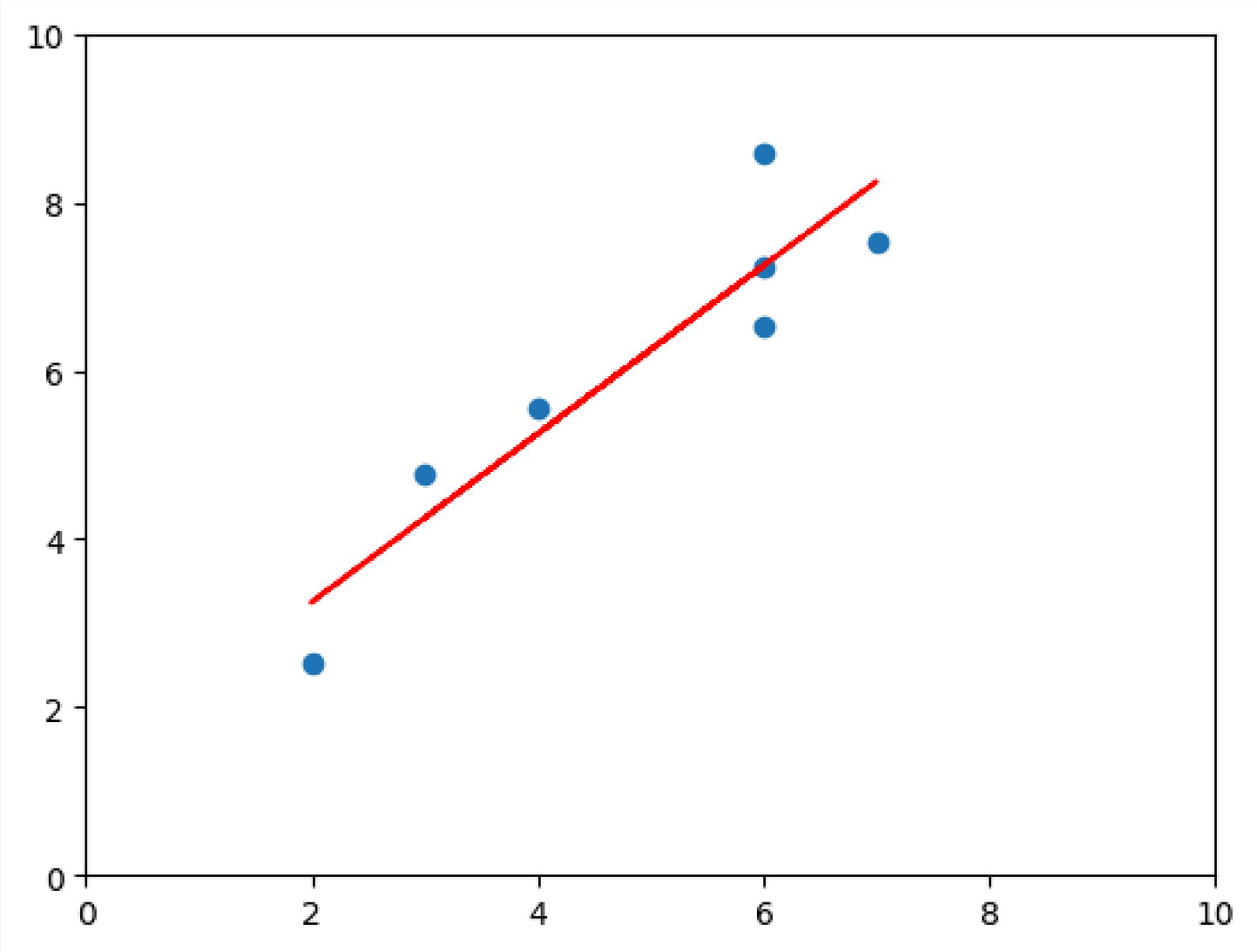
$$\mathcal{L}(\mathbf{w}, (x_i, y_i)) = (y_i - h_{\mathbf{w}}(\mathbf{x}_i))^2 = |y_i - \hat{y}_i|^2$$

$$\mathcal{L}(\mathbf{w}, \mathcal{D}_{train}) = \frac{1}{n} \sum_{i=1}^{n} (y_i - h_{\mathbf{w}}(\mathbf{x}_i))^2$$

PARTIALLY DIFFERENTIATE WITH RESPECT TO W0,W1

EQUATE TO 0 AND FIND W0, W1

EXAMPLES AVOID BLABBERING!



DOUBTS!

What if we had assumed a general 6 degree polynomial instead in the example?

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YOUR DEGREE IS A HYPER-PARAMETER!

(DON'T OVERFIT OR UNDERFIT)

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What if we had assumed a general 6 degree polynomial instead in the example?

What if there are multiple features and multiple output dimensions?

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What if we had assumed a general 6 degree polynomial instead in the example?

What if there are multiple features and multiple output dimensions?

TRY TO EXTRACT IMPORTANT FEATURES FIRST, CREATING NEW IF NECESSARY!

DOUBTS!

What if we had assumed a general 6 degree polynomial instead in the example?

What if there are multiple features and multiple output dimensions?

What if there is no closed form solution of partial derivatives equated to 0?

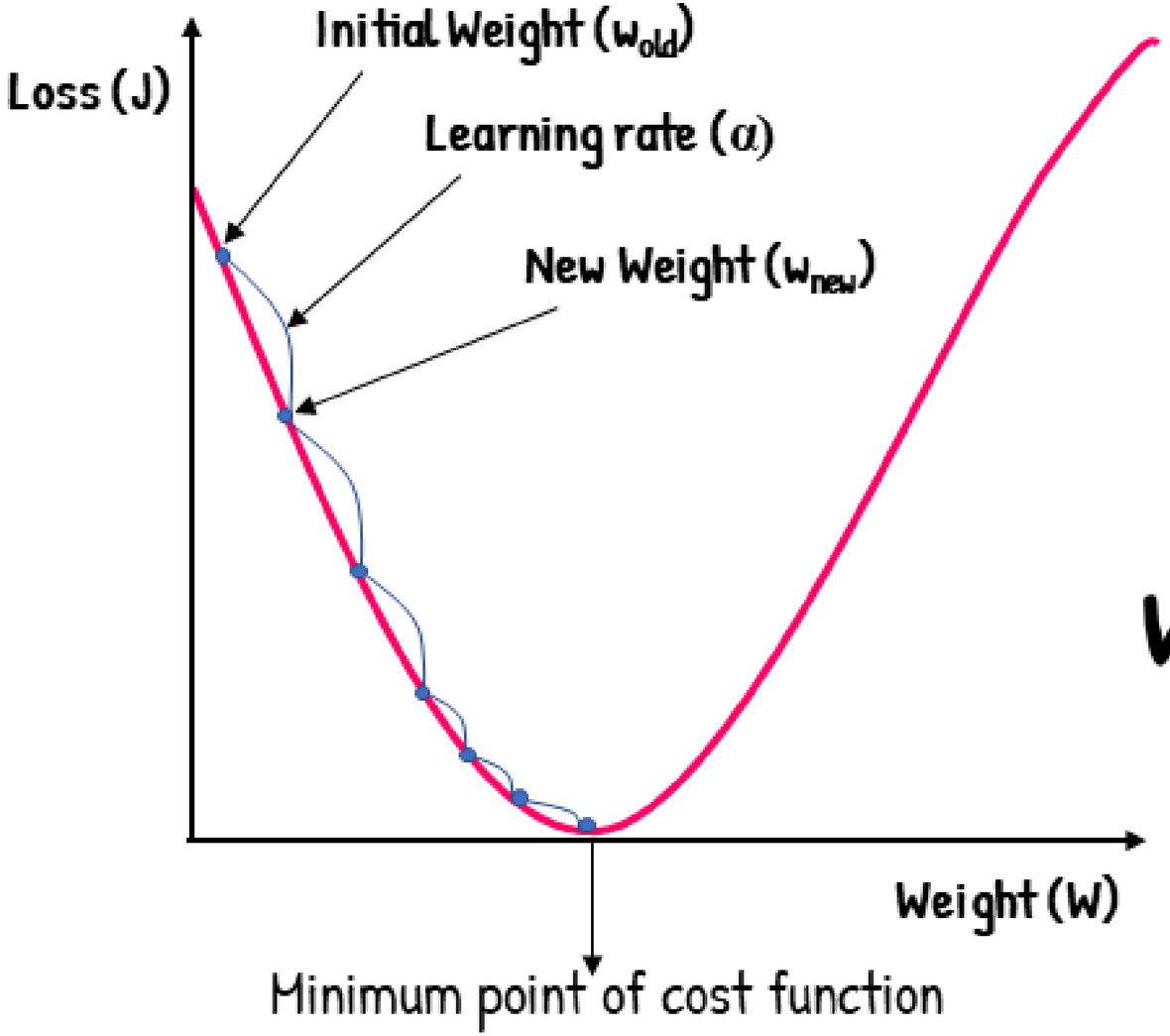
What if there is no closed form solution of partial derivatives equated to 0?

OR AT TIMES

Too time/resource consuming to compute the closed form solution?

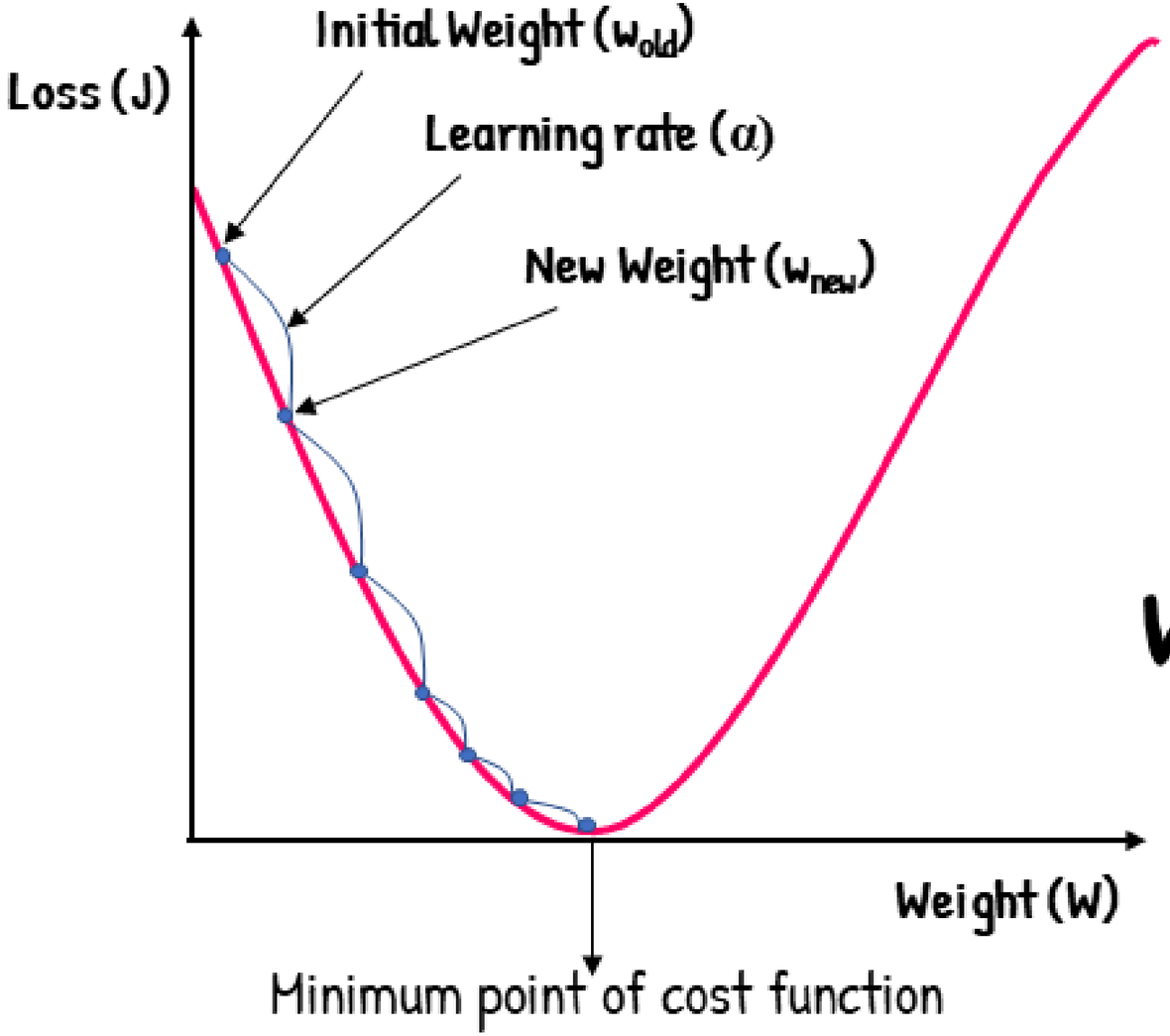
COMPUTE APPROXIMATE SOLUTIONS BY PERFORMING ALGORITHMS LIKE GRADIENT DESCENT!

Gradient Descent



$$w_{new} = w_{old} - \alpha \frac{\delta J}{\delta w}$$

Gradient Descent



ANOTHER HYPER-PARAMETER

$$w_{new} = w_{old} - \alpha \frac{\delta J}{\delta w}$$

SOME BUZZWORDS

EPOCH

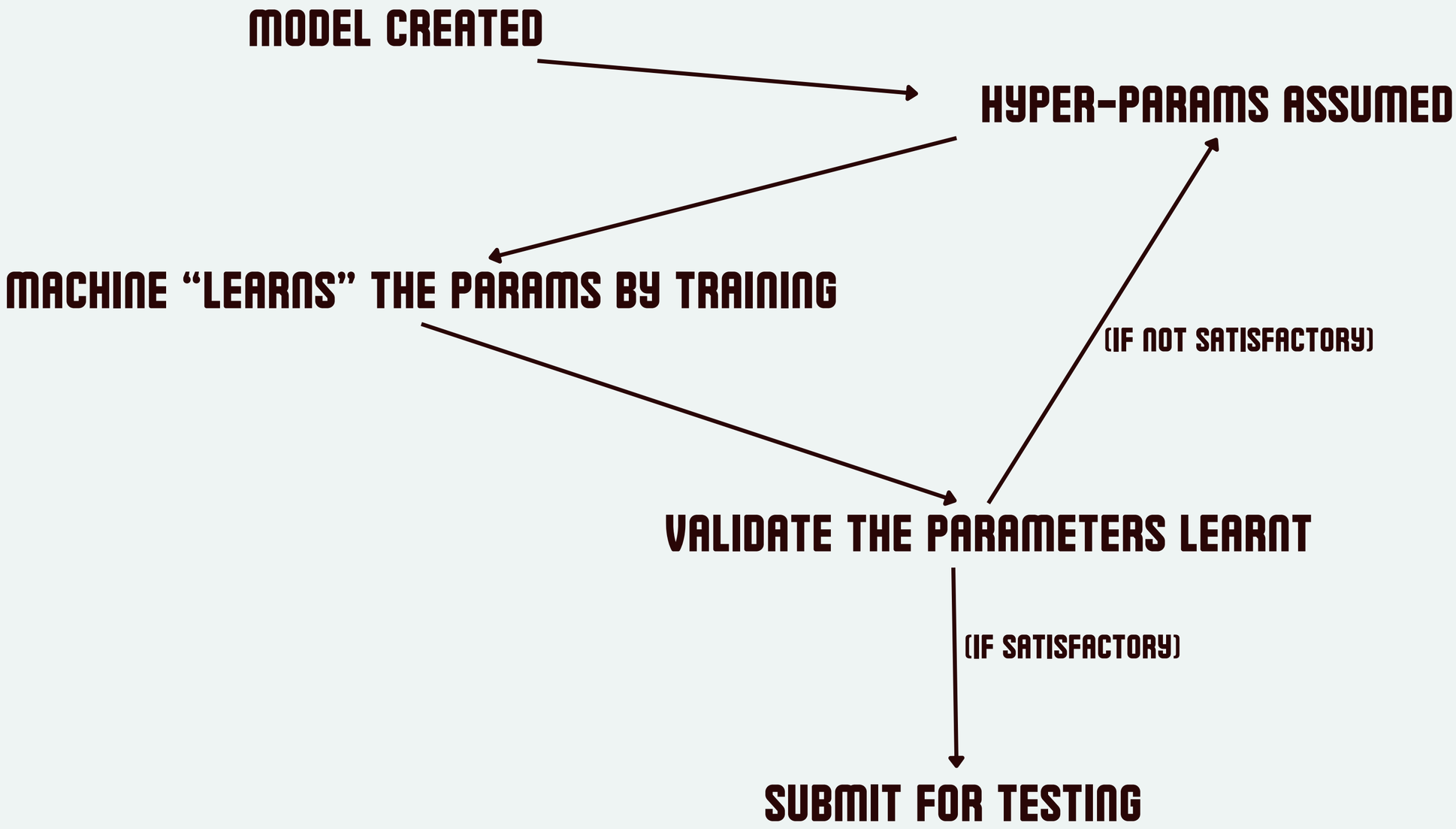
Number of times you use all of your data to descend

BATCH

If you have more resources, group your data-points and calculate gradient with respect to the group

- TRAINING
- VALIDATING
- TESTING

OVERVIEW


MODEL CREATED
HYPER-PARAMS ASSUMED
MACHINE "LEARNS" THE PARAMS BY TRAINING
(IF NOT SATISFACTORY)
VALIDATE THE PARAMETERS LEARNT
(IF SATISFACTORY)
SUBMIT FOR TESTING

Interesting Points!

Thank You!