AI LAB WEEK 9

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APPLY FUZZY LOGIC

- It is necessary to compare two sensors based upon their detection levels and gain settings. The table of gain settings and sensor detection levels with a standard item being monitored providing typical membership values to represent the detection levels for each sensor is given in Table.

Gain	Detection Level Sensor 1	Detection Level Sensor 2
0	0	0
10	0.2	0.35
20	0.35	0.25
30	0.65	0.8
40	0.85	0.95
50	1	1

APPLY FUZZY LOGIC

- Now given the universe of discourse $X = \{0, 10, 20, 30, 40, 50\}$ and the membership functions for the two sensors in discrete form as

$$\underset{\sim}{D}_1 = \left\{\frac{0}{0} + \frac{0.2}{10} + \frac{0.35}{20} + \frac{0.65}{30} + \frac{0.85}{40} + \frac{1}{50}\right\}$$

$$\underset{\sim}{D}_2 = \left\{\frac{0}{0} + \frac{0.35}{10} + \frac{0.25}{20} + \frac{0.8}{30} + \frac{0.95}{40} + \frac{1}{50}\right\}$$

Gain	Detection Level Sensor 1	Detection Level Sensor 2
0	0	0
10	0.2	0.35
20	0.35	0.25
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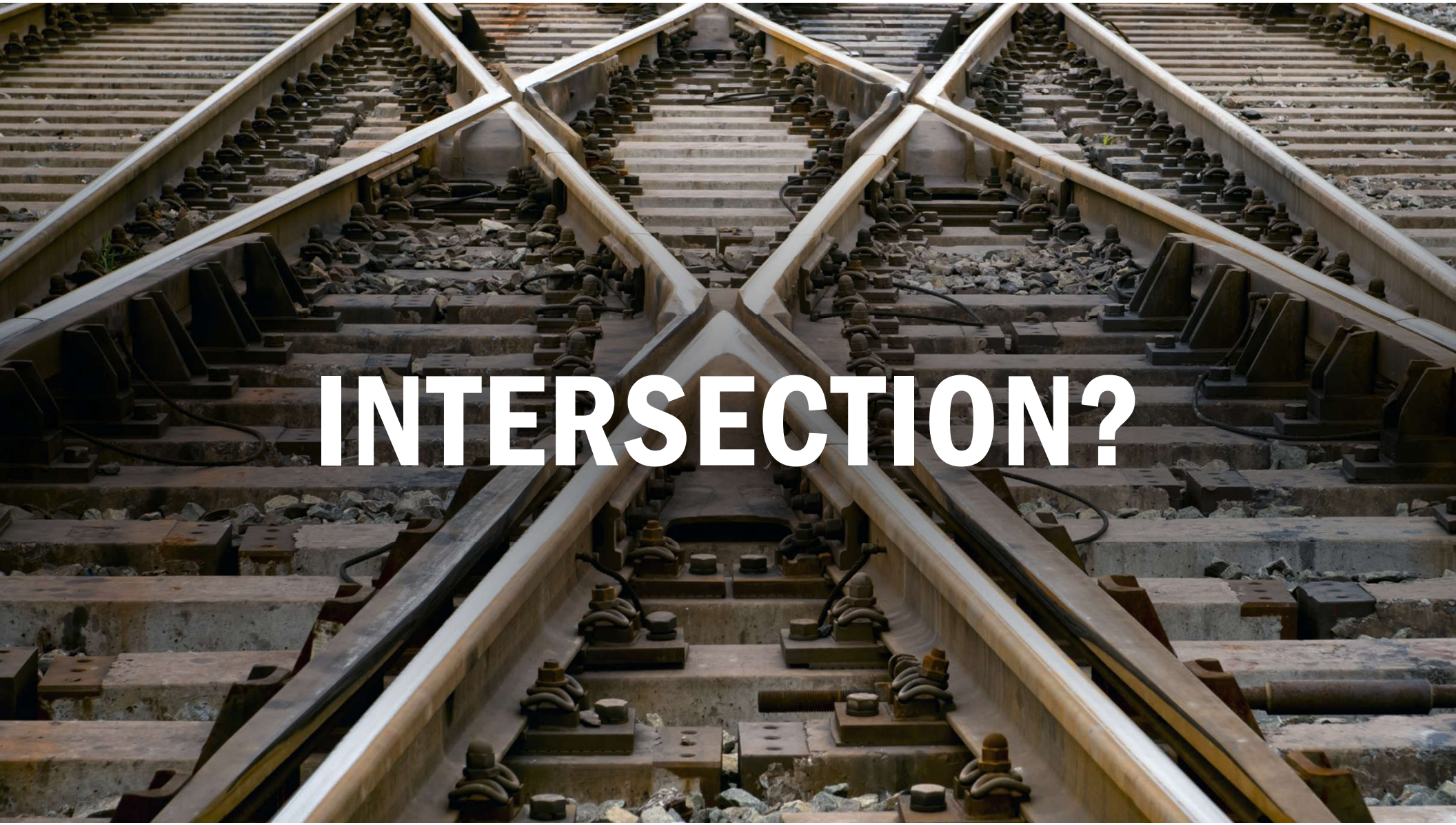
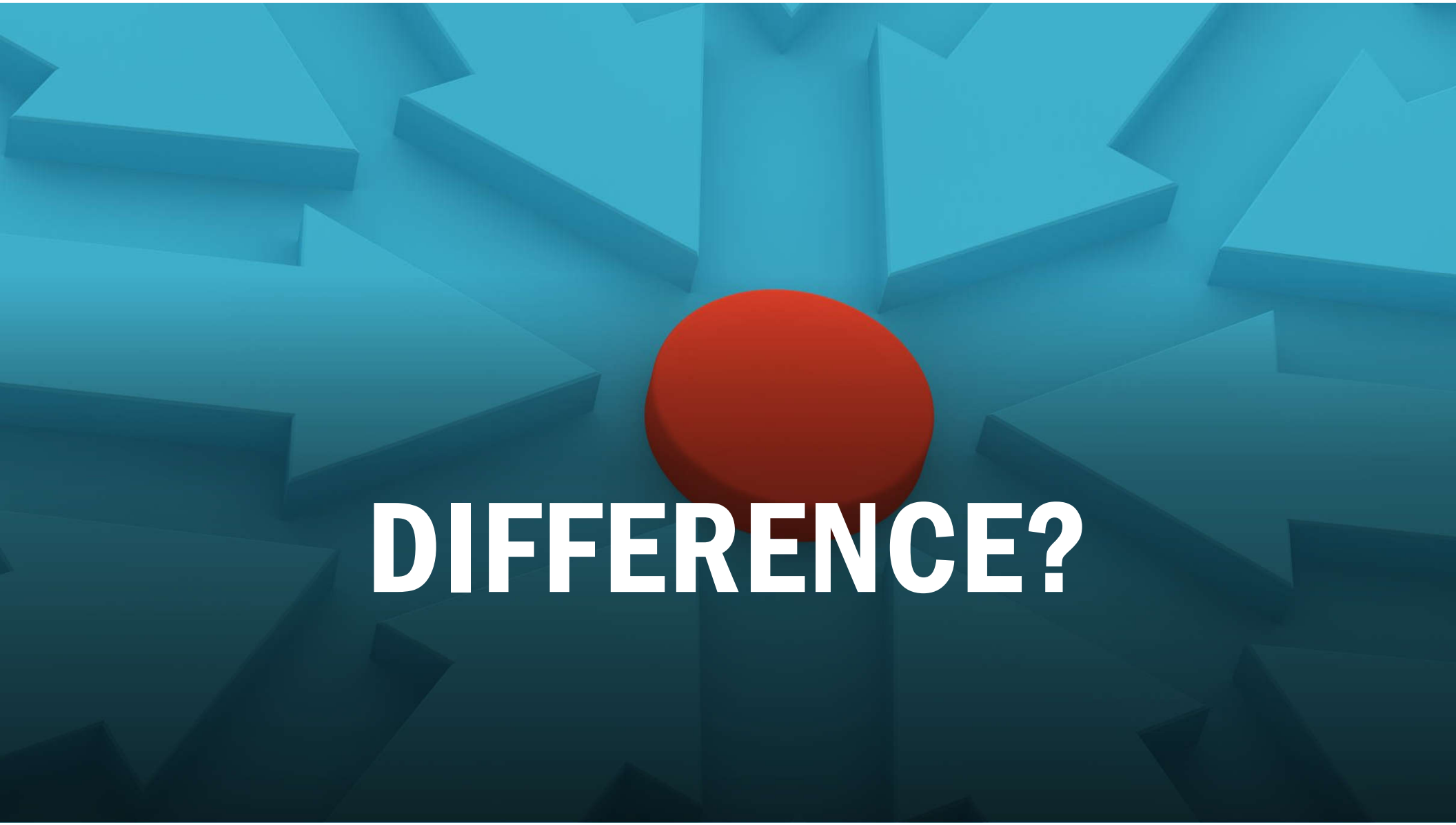
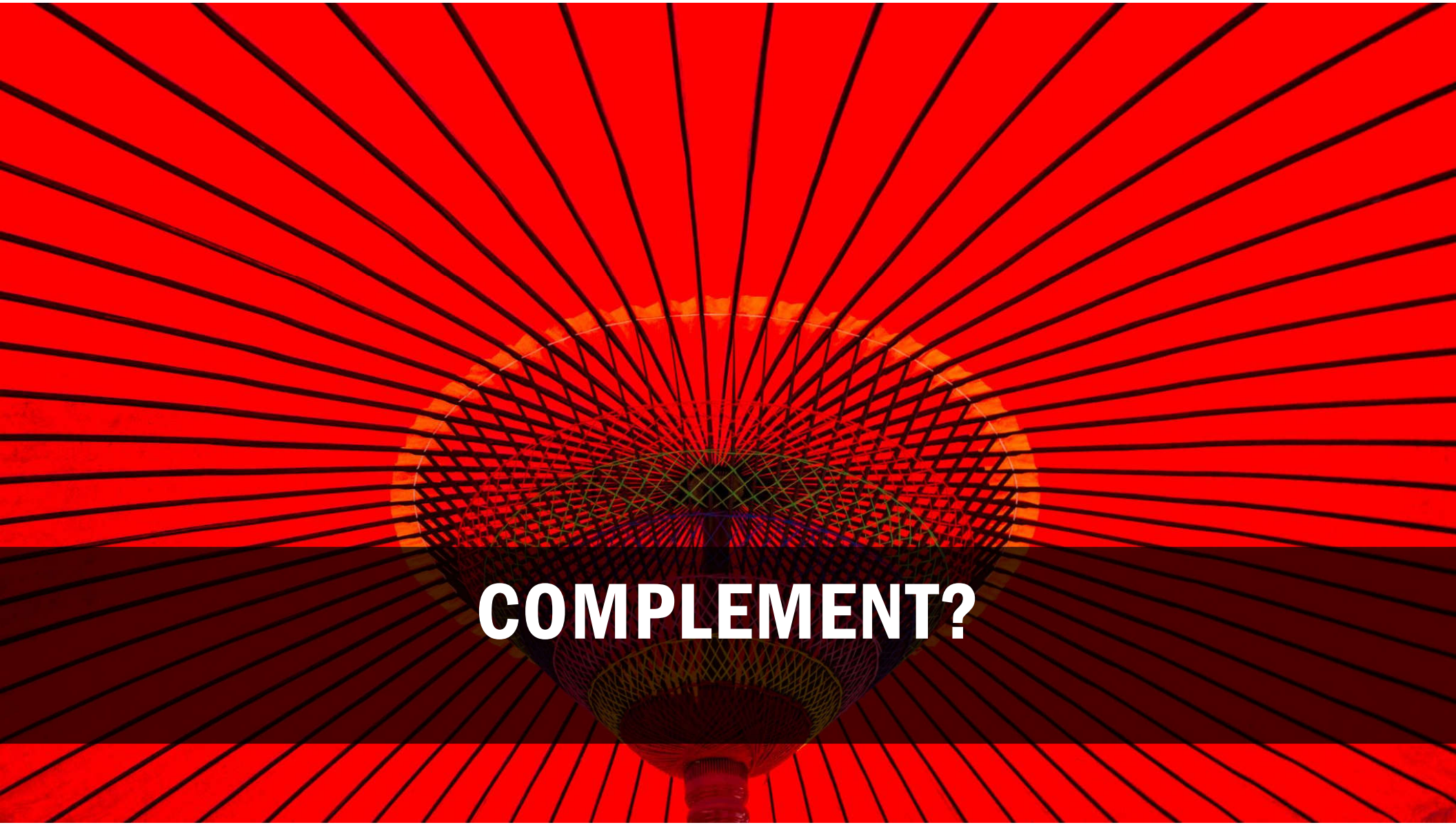
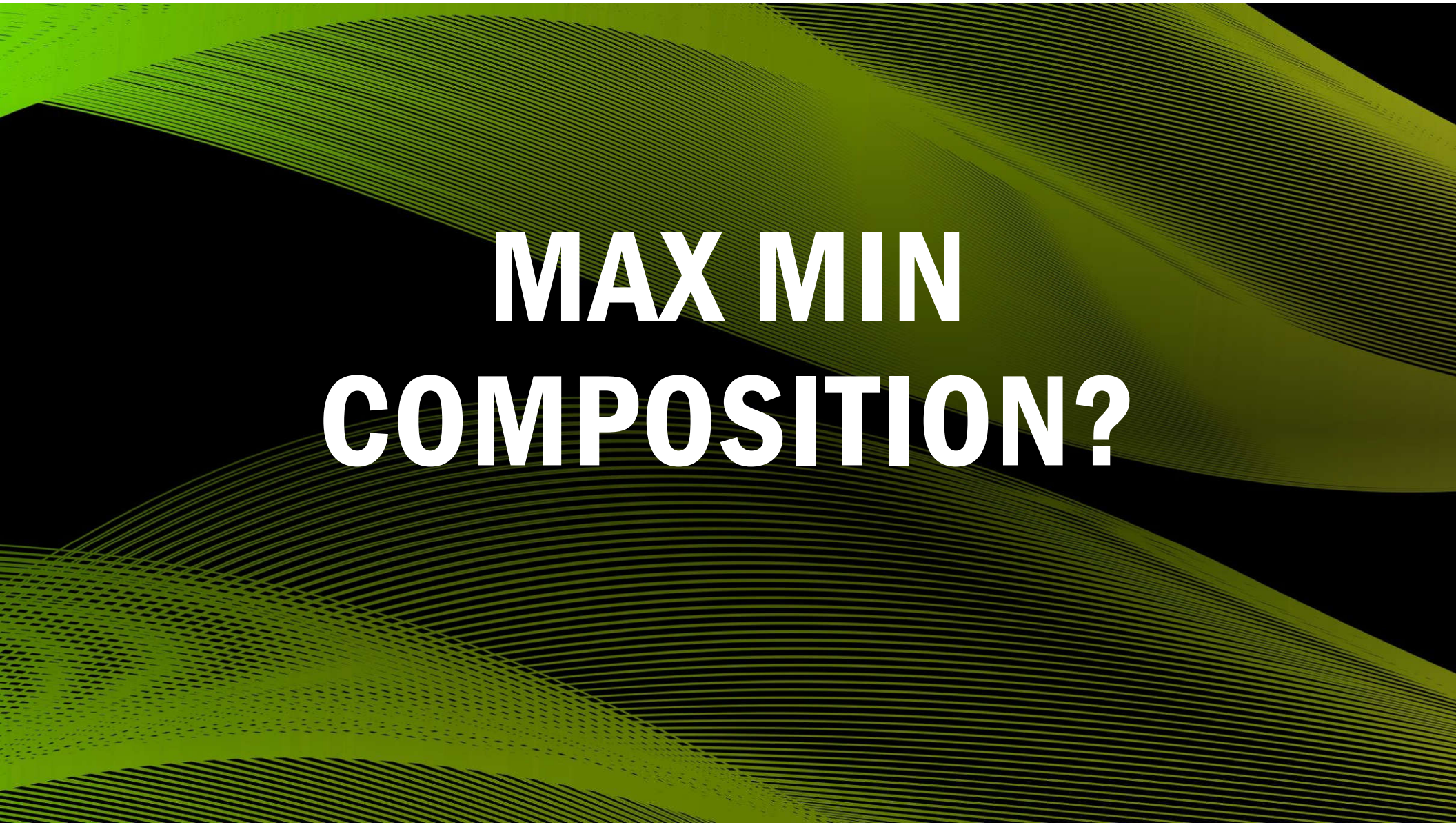
40	0.85	0.95
50	1	1


UNION?


INTERSECTION?


DIFFERENCE?


COMPLEMENT?


MAX MIN
COMPOSITION?


MAX PRODUCT
COMPOSITION?


PYTHON CODE

TASK 1, 2, 3 AND 4

```
import numpy as np
# Membership values (gain settings)
membership_values = [0, 10, 20, 30, 40, 50]
# Detection levels for Sensor 1 and Sensor 2
sensor1 = [0, 0.2, 0.35, 0.65, 0.85, 1]
sensor2 = [0, 0.35, 0.25, 0.8, 0.95, 1]
# Union
union = np.maximum(sensor1, sensor2)
print("Union: ", dict(zip(membership_values, union)))
```

TASK 1, 2, 3 AND 4

```
# Intersection

intersection = np.minimum(sensor1, sensor2)

print("Intersection: ", dict(zip(membership_values, intersection)))

# Difference (Sensor1 - Sensor2)

difference = np.maximum(0, np.array(sensor1) - np.array(sensor2))

print("Difference (Sensor1 - Sensor2): ",
dict(zip(membership_values, difference)))
```

TASK 1, 2, 3 AND 4

```
# Complement

complement_sensor1 = [1 - d for d in sensor1]

complement_sensor2 = [1 - d for d in sensor2]

print("Complement of Sensor 1: ", dict(zip(membership_values,
complement_sensor1)))

print("Complement of Sensor 2: ", dict(zip(membership_values,
complement_sensor2)))
```

TASK 5 AND 6

```
import numpy as np

# Define sets A and B

A = np.array([[0.6, 0.3], [0.2, 0.9]])

B = np.array([[1, 0.5, 0.3], [0.8, 0.4, 0.7]])s

# Max-Min Composition

maxmin_min_composition = np.zeros((A.shape[0], B.shape[1]))
```

TASK 5 AND 6

```
for i in range(A.shape[0]):
    for j in range(B.shape[1]):
        min_values = [min(A[i, k], B[k, j]) for k in range(A.shape[1])]
        max_min_composition[i, j] = max(min_values)

print("Max_Min_Composition:")
print(max_min_composition)
```

TASK 5 AND 6

```
# Max-Product Composition
max_product_composition = np.zeros((A.shape[0], B.shape[1]))
for i in range(A.shape[0]):
    for j in range(B.shape[1]):
        product_values = [A[i, k] * B[k, j] for k in range(A.shape[1])]
        max_product_composition[i, j] = max(product_values)
print("Max-Product Composition:")
print(max_product_composition)
```

TASKS

Task#1: Find the union according to the Gain value of sensor1 and 2 detection values.

Task#2: Find the intersection.

Task#3: Find the difference

Task#4: Find the Complement.

Task#5: Min max composition.

Task#6: Max product of two fuzzy sets.