EM–CURE
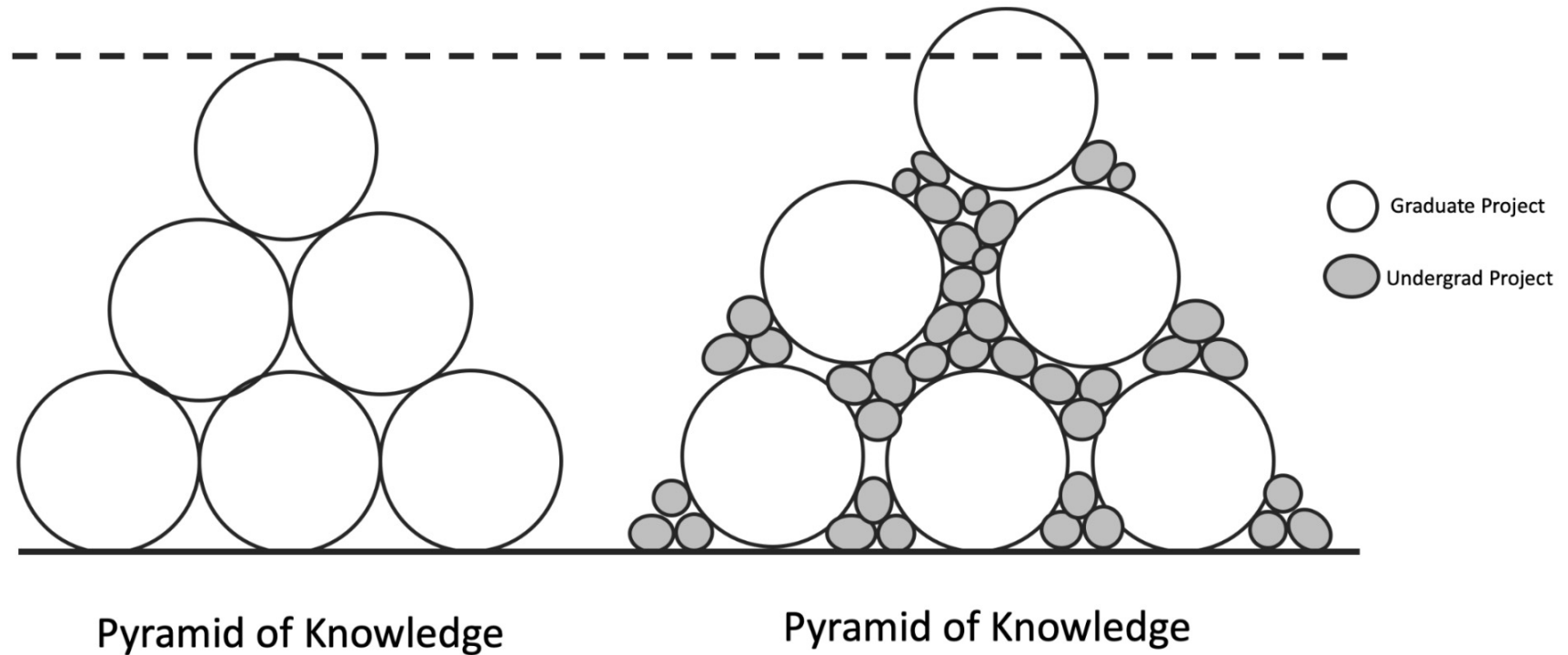
Entrepreneurially **M**inded **C**ourse-based **U**ndergraduate **R**esearch **E**xperiences

Pyramid of Knowledge

Pyramid of Knowledge
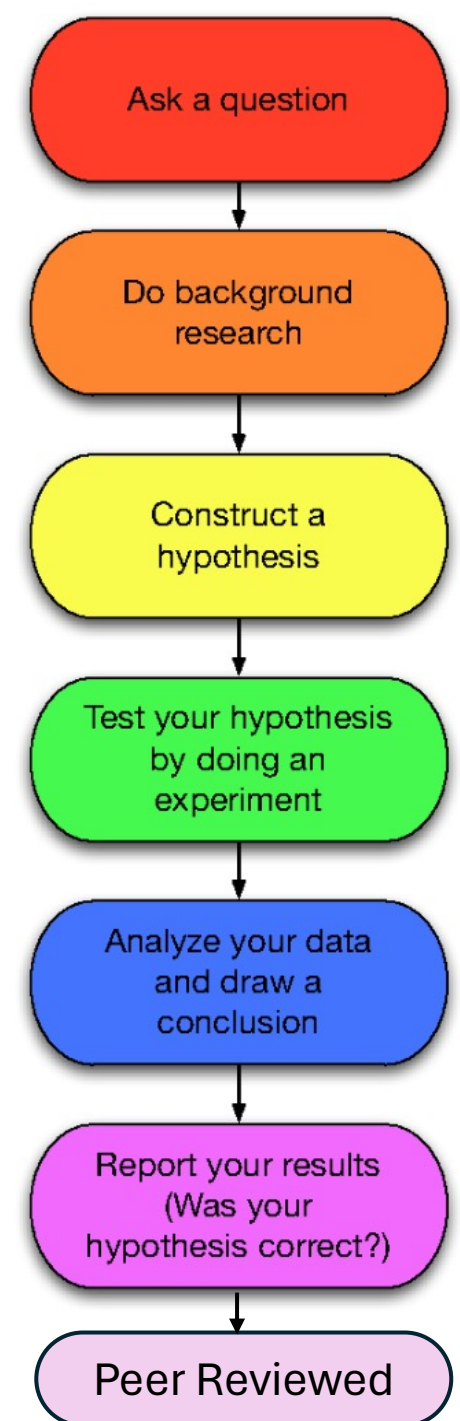
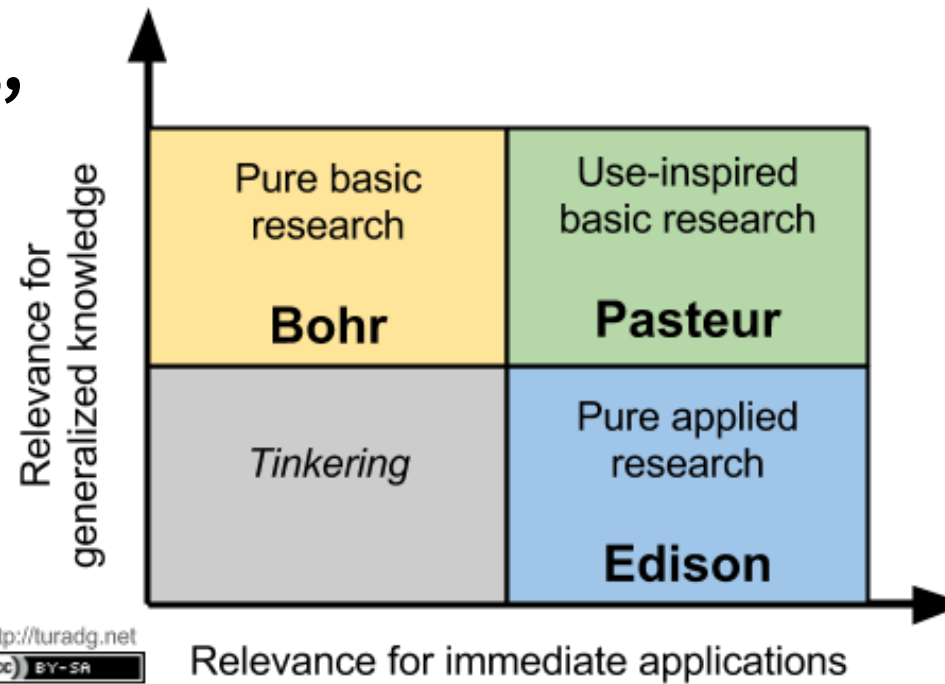Graduate Project

Undergrad Project

The Scientific Method

- **Research** *vs.* being informed by research
- **Scientist** *vs.* being part of a scientific community

Pyramid of Knowledge

Ask a question

Do background research

Construct a hypothesis

Test your hypothesis by doing an experiment

Analyze your data and draw a conclusion

Report your results (Was your hypothesis correct?)

Peer Reviewed
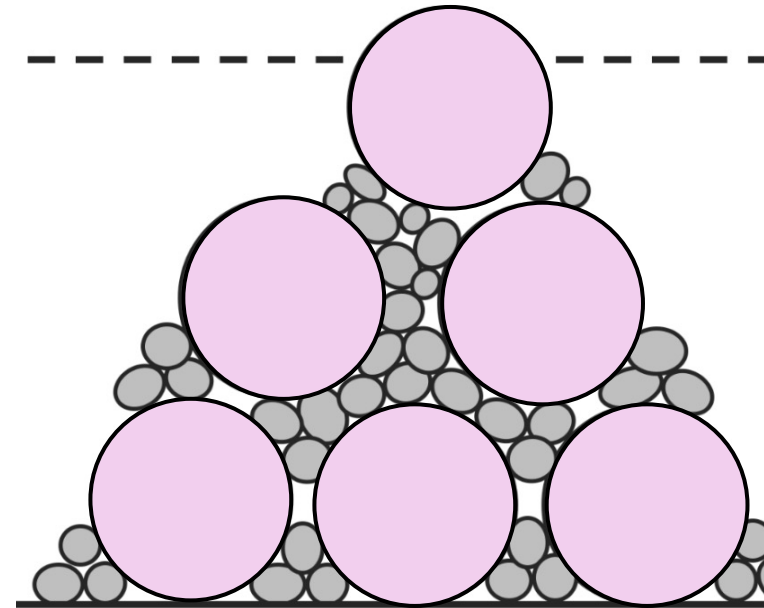
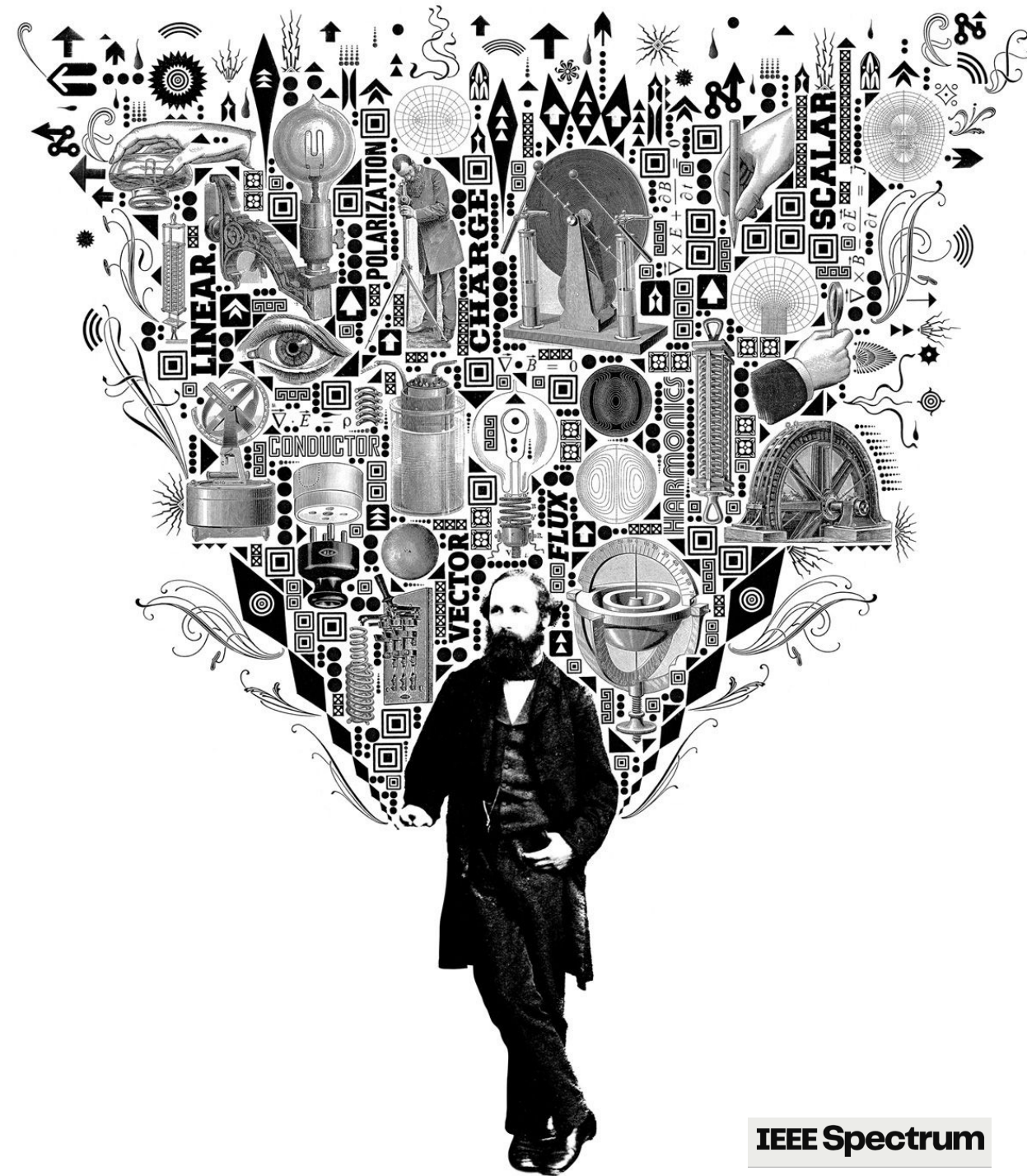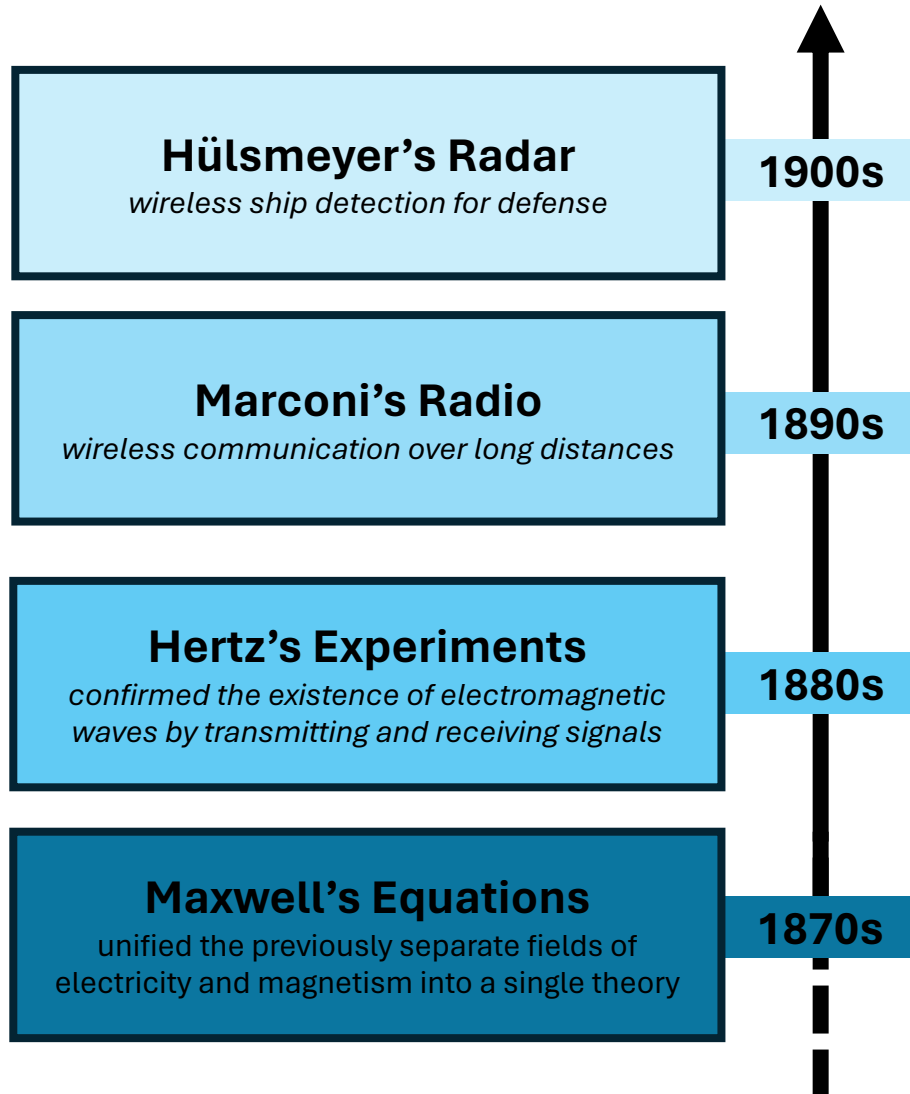# Research "Quadrants"

President Truman

vs.

Vannevar Bush

"Discoveries pertinent to medical progress have often come from remote and unexpected sources and it is certain that this will be true in the future."

An EE Example

Hülsmeyer's Radar
wireless ship detection for defense

1900s

Marconi's Radio
wireless communication over long distances

1890s

Hertz's Experiments
confirmed the existence of electromagnetic waves by transmitting and receiving signals

1880s

Maxwell's Equations
unified the previously separate fields of electricity and magnetism into a single theory
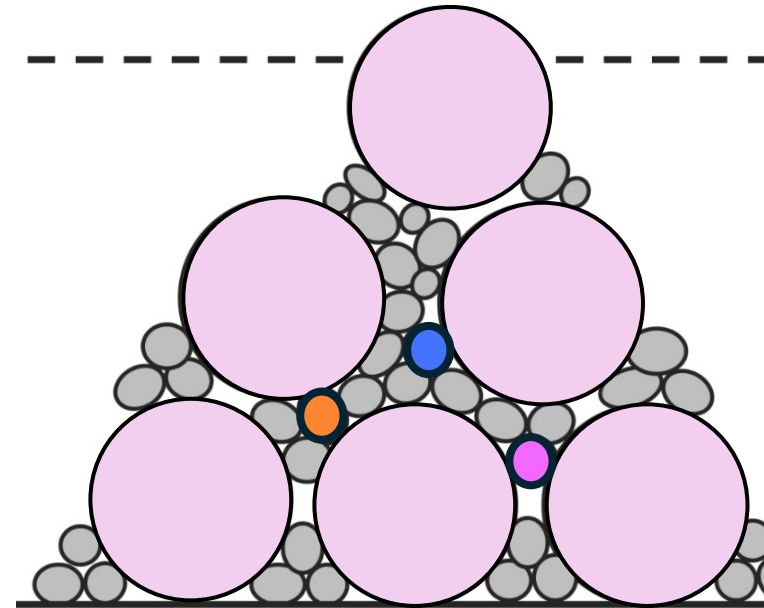
1870s

IEEE Spectrum
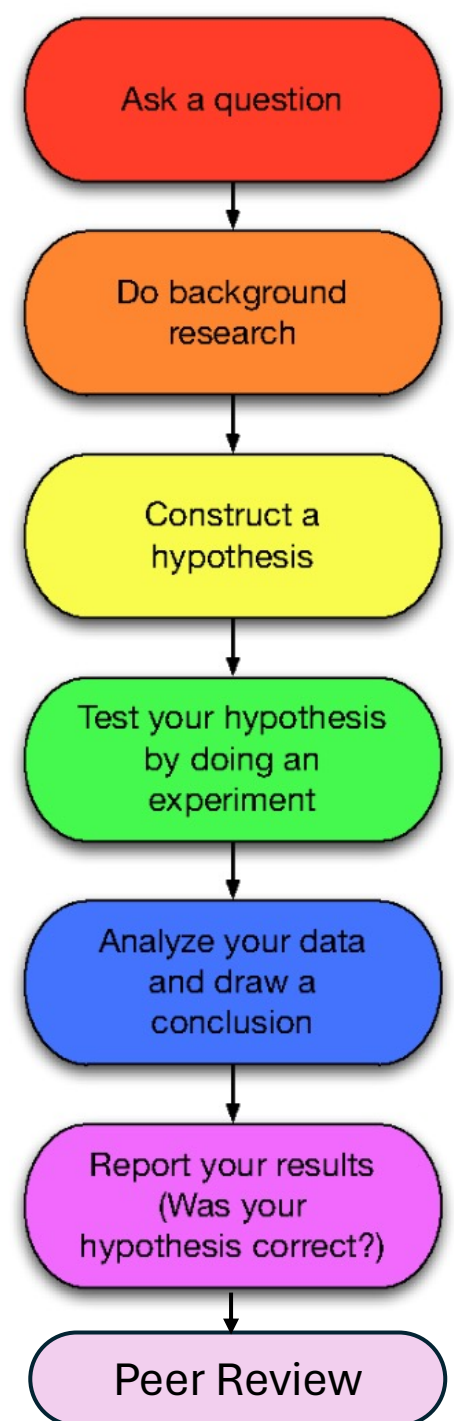
Assignment

Part 1: 'Cleaning' a dataset

- Action: Decide how to handle missing data or formatting errors.

- Questions: What are the implications of these decisions on future data utilization?

Part 2: Presenting a dataset

- Action: Decide on three graphical representations for the same dataset.

- Questions: What are the implications of these insights in the future use of this data set?

Pyramid of Knowledge

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🏠 » Buildings » End-Use Load Profiles for the U.S. Building Stock

ComStock
End-Use Load Profiles
foresee

End-Use Load Profiles for the U.S. Building Stock

NREL and its research partners have developed a database of end-use load profiles (EULP) representing all major end uses, building types, and climate regions in the U.S. commercial and residential building stock.

Buildings

Object
dc-fullservicerestaurant.csv
dc-hospital.csv
dc-largehotel.csv
dc-largeoffice.csv
dc-mediumoffice.csv
dc-outpatient.csv
dc-primaryschool.csv
dc-quickservicerestaurant.csv
dc-retailstandalone.csv
dc-retailstripmall.csv
dc-secondaryschool.csv
dc-smallhotel.csv
dc-smalloffice.csv
dc-warehouse.csv

Building Features

state
in.building_type
timestamp
models_used
floor_area_represented
out.district_cooling.cooling.energy_consumption
out.district_heating.heating.energy_consumption
out.district_heating.water_systems.energy_consumption
out.electricity.cooling.energy_consumption
out.electricity.exterior_lighting.energy_consumption
out.electricity.fans.energy_consumption
out.electricity.heat_recovery.energy_consumption
out.electricity.heat_rejection.energy_consumption
out.electricity.heating.energy_consumption
out.electricity.interior_equipment.energy_consumption
out.electricity.interior_lighting.energy_consumption
out.electricity.pumps.energy_consumption
out.electricity.refrigeration.energy_consumption
out.electricity.water_systems.energy_consumption
out.natural_gas.heating.energy_consumption
out.natural_gas.interior_equipment.energy_consumption
out.natural_gas.water_systems.energy_consumption
out.district_cooling.total.energy_consumption
out.district_heating.total.energy_consumption
out.electricity.total.energy_consumption
out.natural_gas.total.energy_consumption
out.other_fuel.heating.energy_consumption
out.other_fuel.water_systems.energy_consumption
out.other_fuel.total.energy_consumption
out.site_energy.total.energy_consumption

Assignment

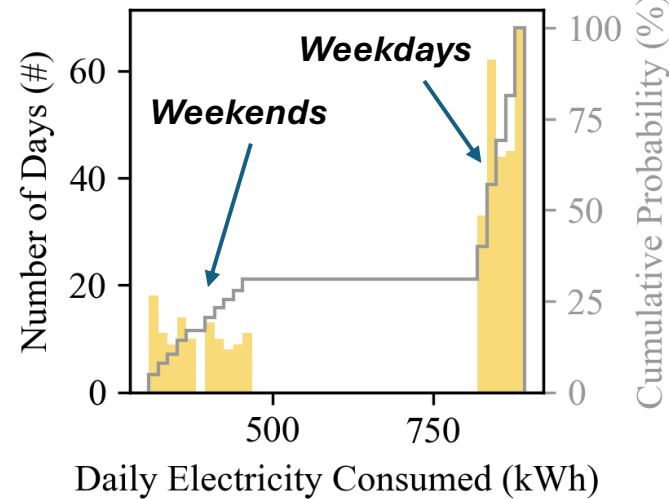## Part 1: 'Cleaning' a dataset

- Action: Decide how to handle missing data or formatting errors.

- Questions: What are the implications of these decisions on future data utilization?

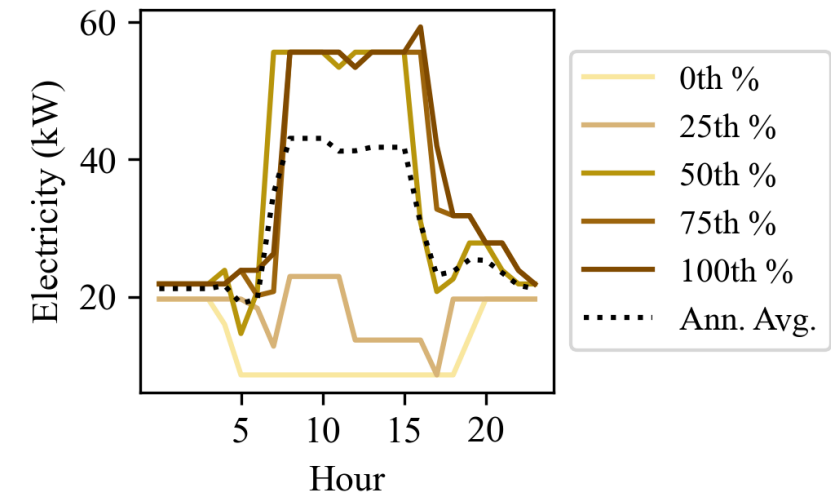## Part 2: Presenting a dataset

- Action: Decide on three graphical representations for the same dataset.

- Questions: What are the implications of these insights in the future use of this data set?

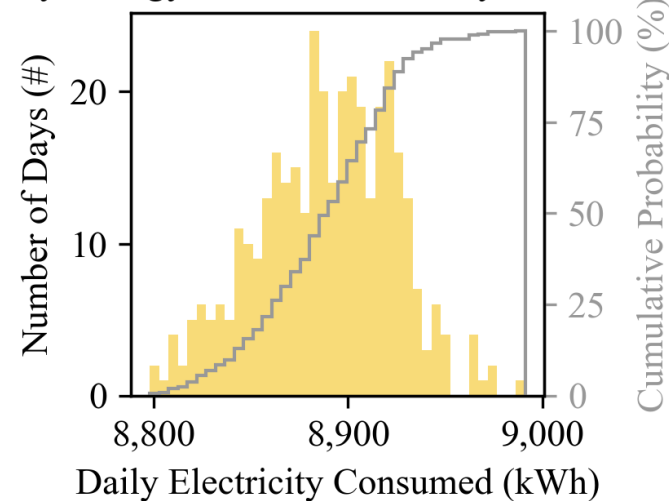**Office Building**

Daily Energy Need - Probability Distribution

Weekdays

Weekends

Daily Load - Samples and Average

Legend: 0th %, 25th %, 50th %, 75th %, 100th %, Ann. Avg.

Quick Service Restaurant

Daily Energy Need - Probability Distribution

Daily Load - Samples and Average

Legend: 0th %, 25th %, 50th %, 75th %, 100th %, Ann. Avg.

Dinner Rush
Lunch Rush
Breakfast Rush