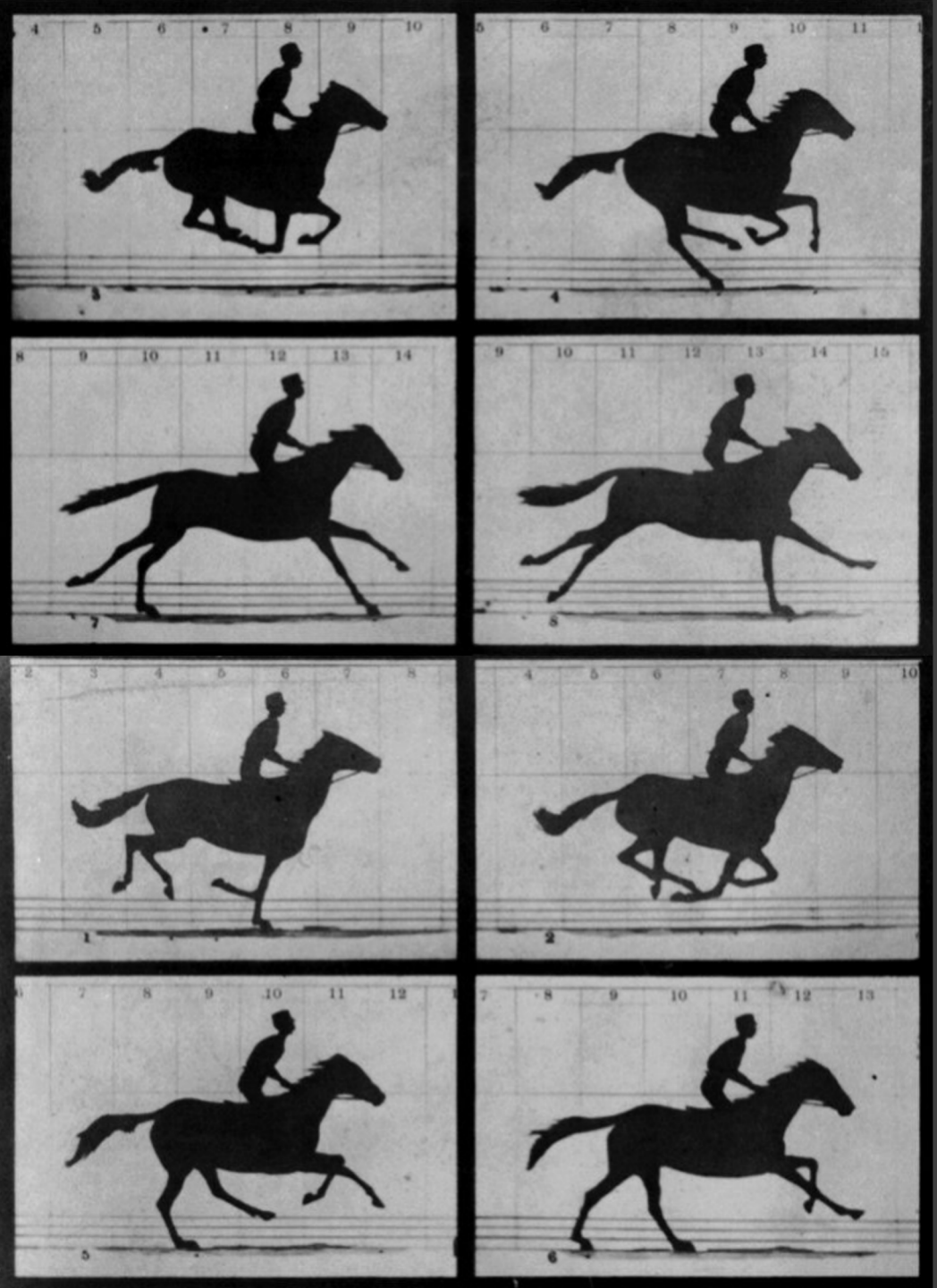


Noureldien Hussein

Aspects of Time

for Recognizing Human Activities

1

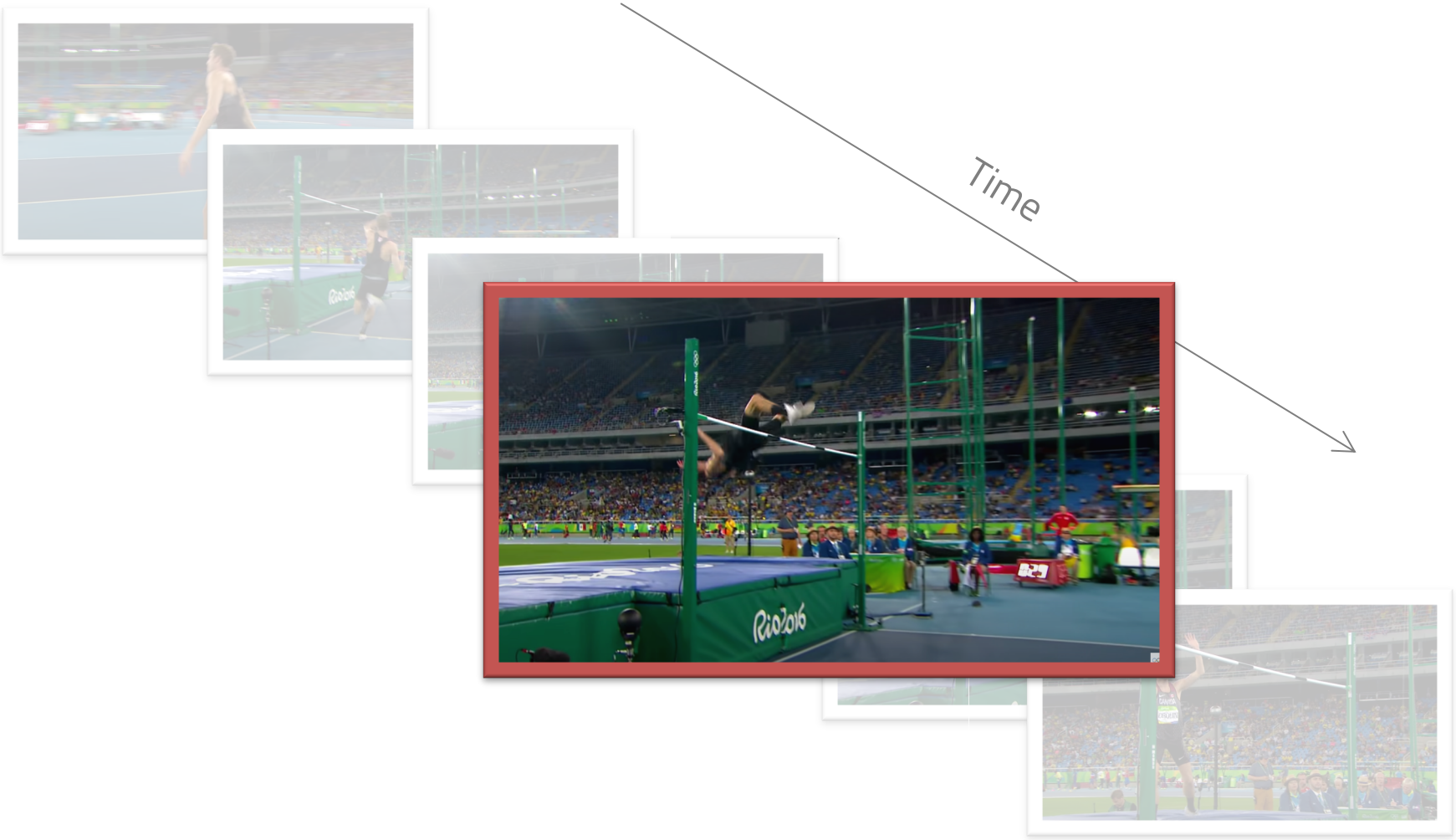
Research Questions

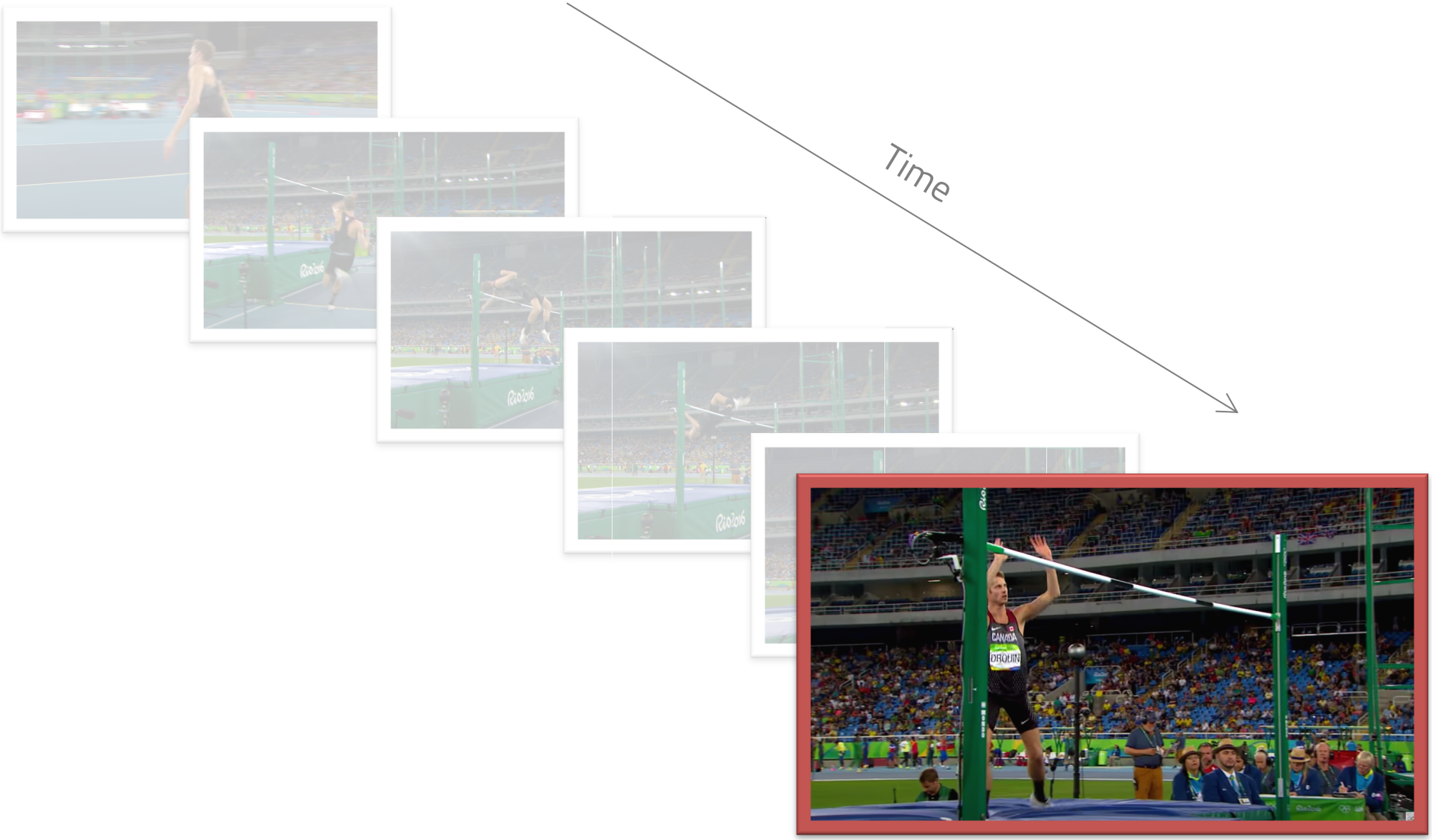
If a picture is worth a thousand words,

Is a video worth a million words?


Play (k)

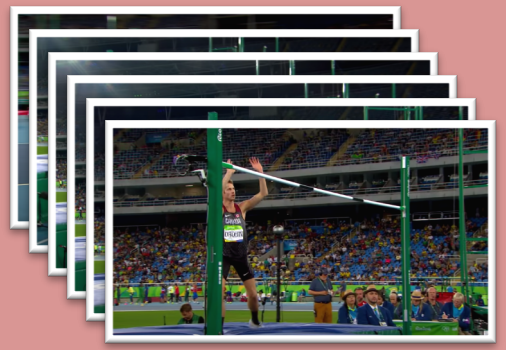

Time


Time
Rio2016


Time
CANADA
DRQUIN

Image

Collection of Images

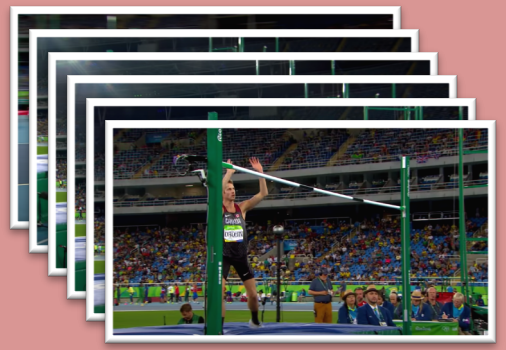


Video

Image

Collection of Images

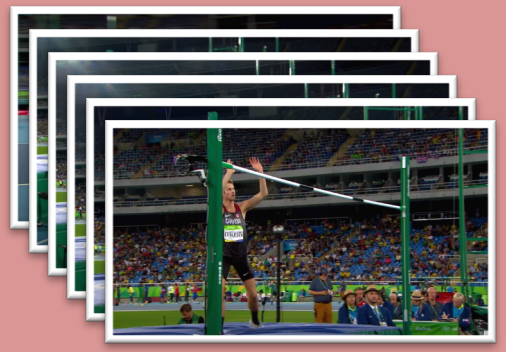
Time



Video

Image

Time



Video

Collection of Images

Why do we need to

understand videos?

one

minute

one

minute

500

hours

The thesis explains a few

Aspects of Time

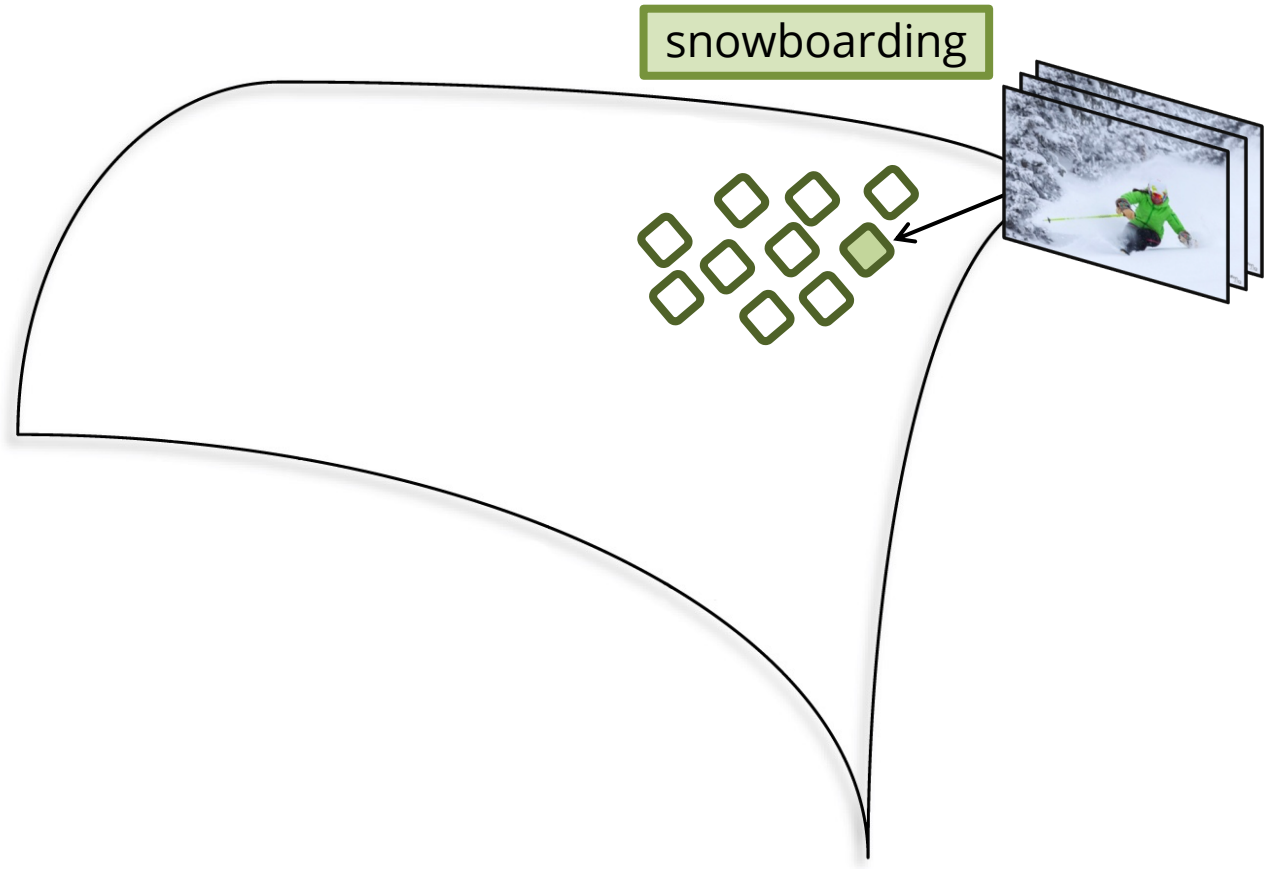
2

Research Contribution

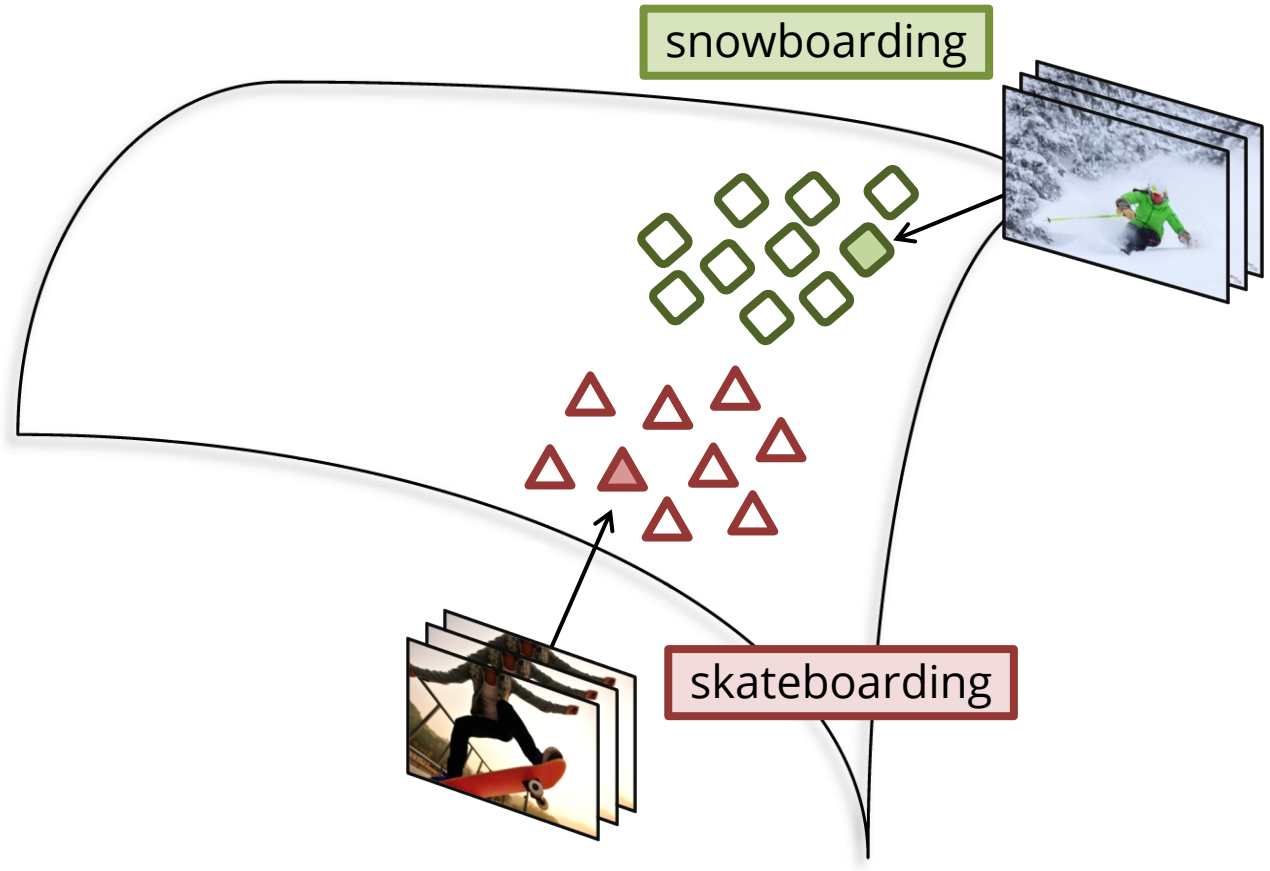
Chapter Two

Past and Future in Time

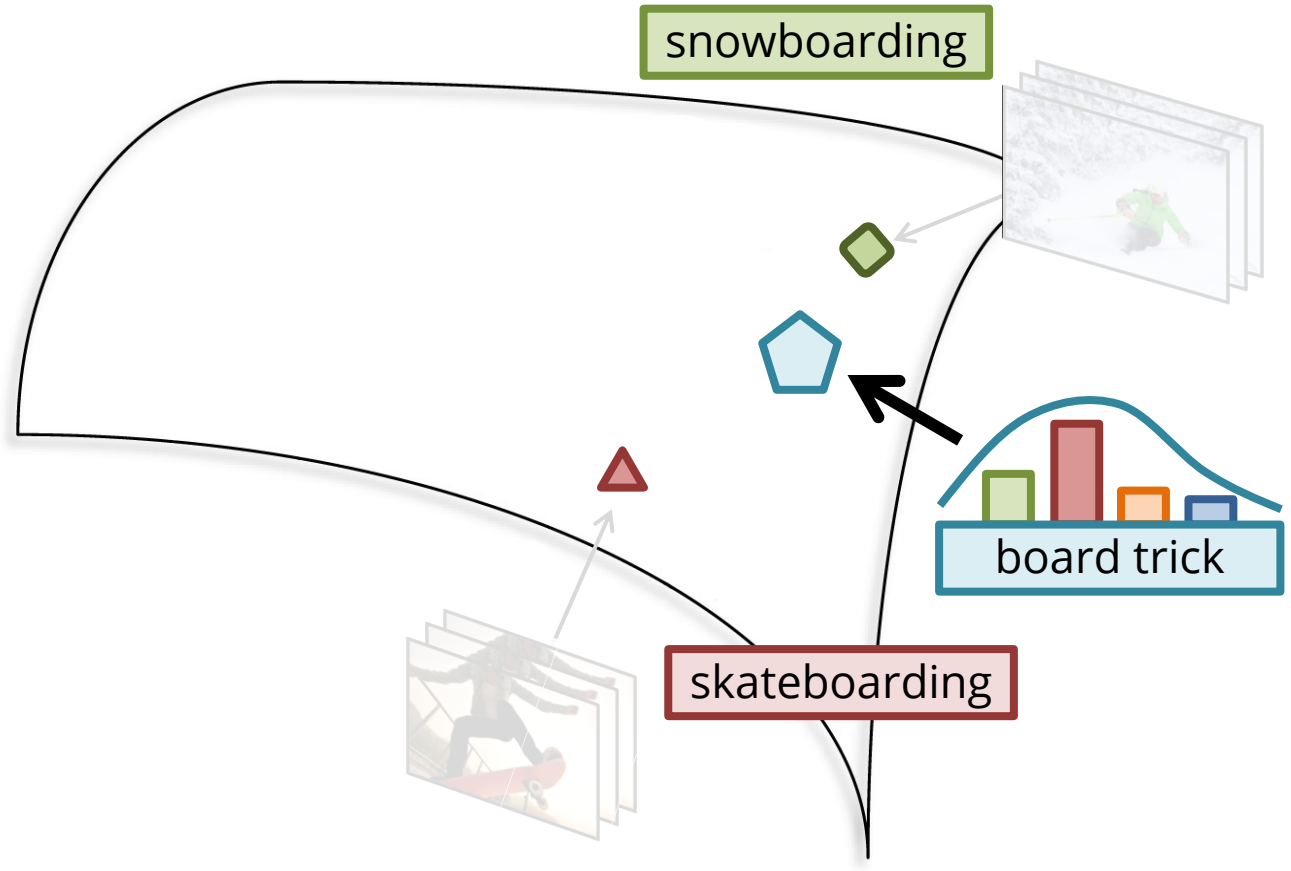
Recognizing Novel Human Activities



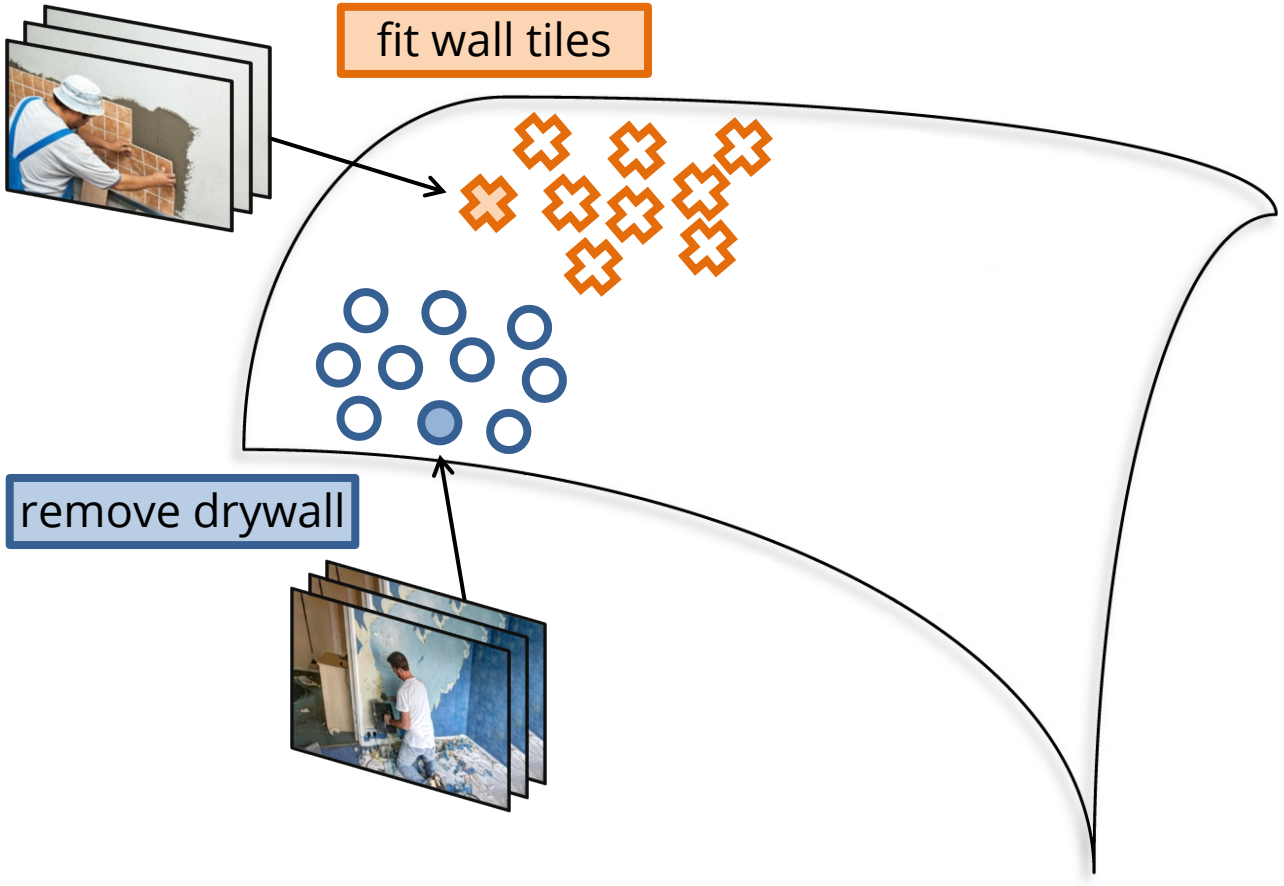
Recognizing Novel Human Activities



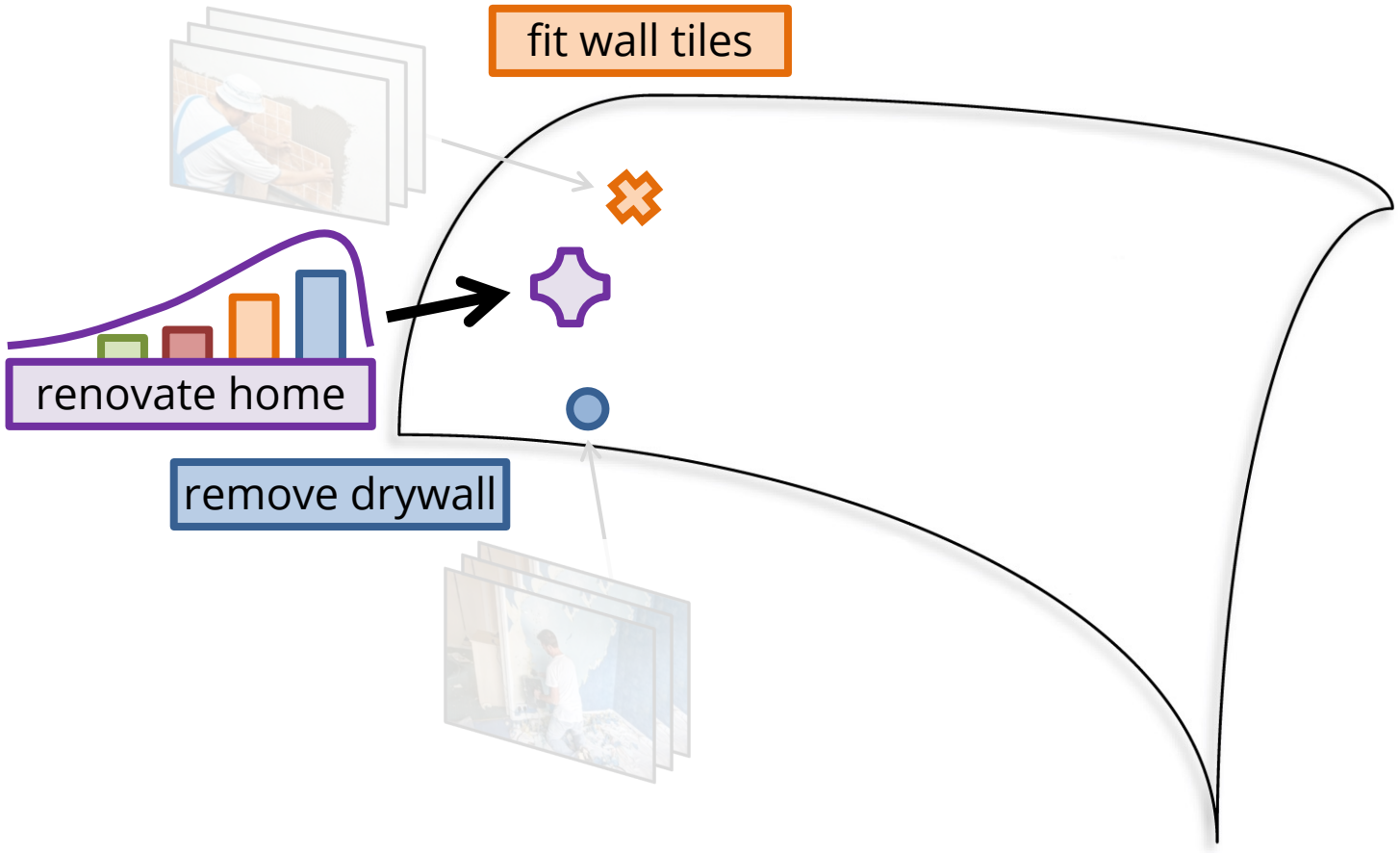
Recognizing Novel Human Activities



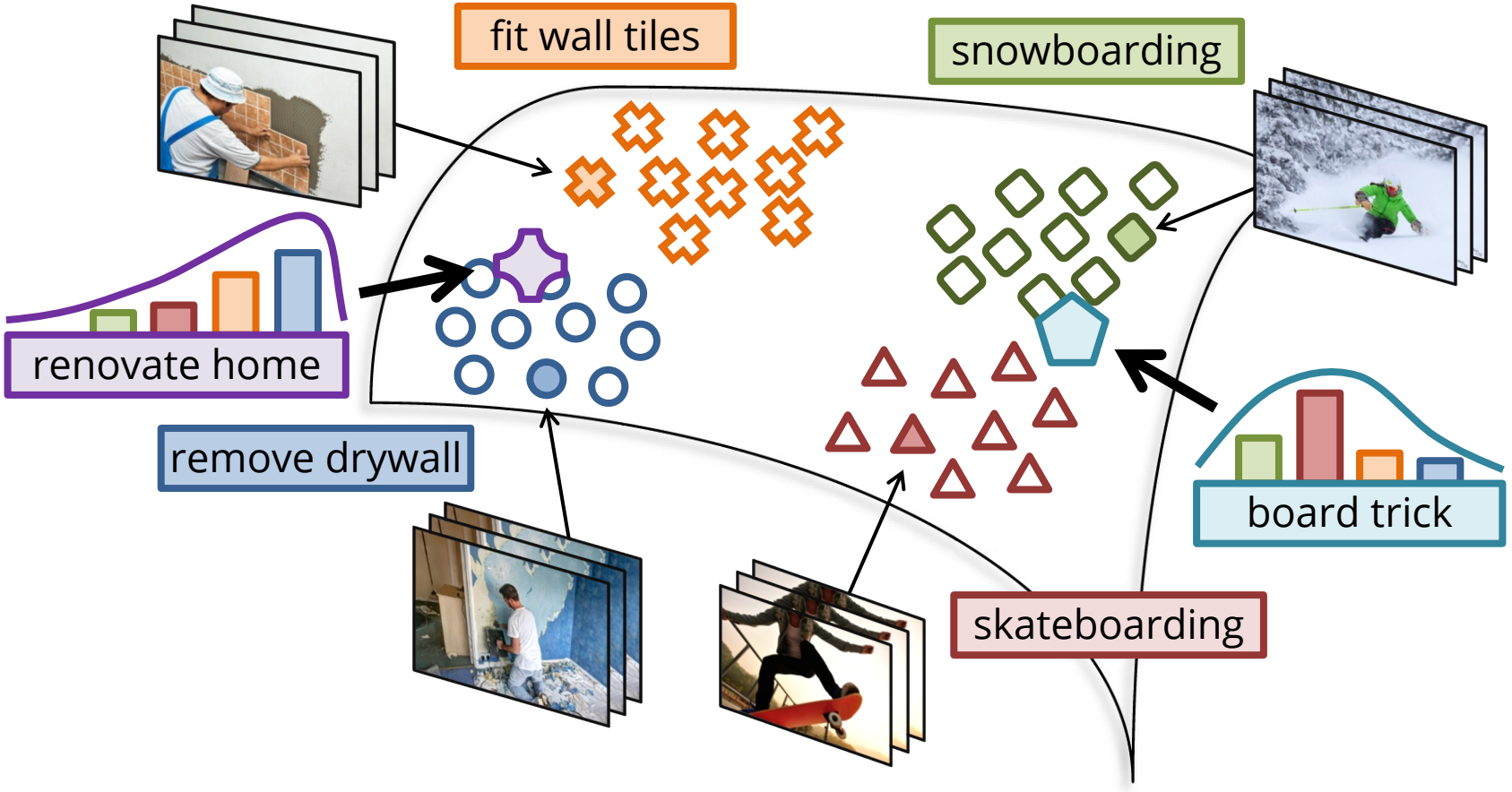
Recognizing Novel Human Activities



Recognizing Novel Human Activities



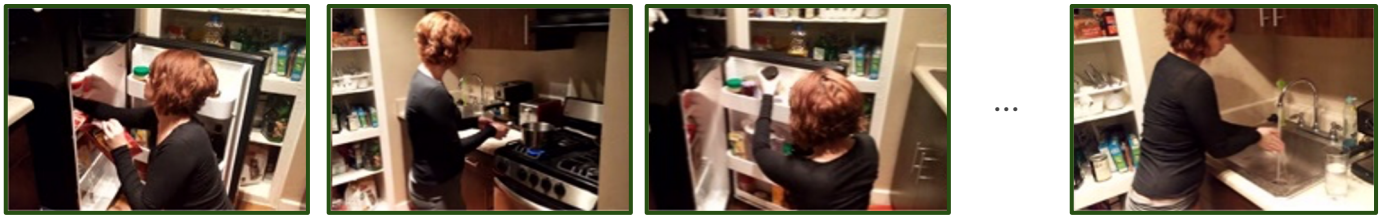
Recognizing Novel Human Activities



Chapter Three

Structure of Time

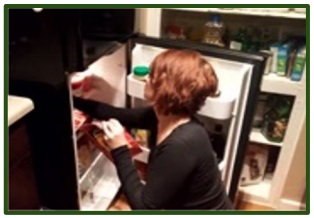
Complex Human Activities



get cook put ... wash

Complex Activity ~30 sec.

Complex Human Activities



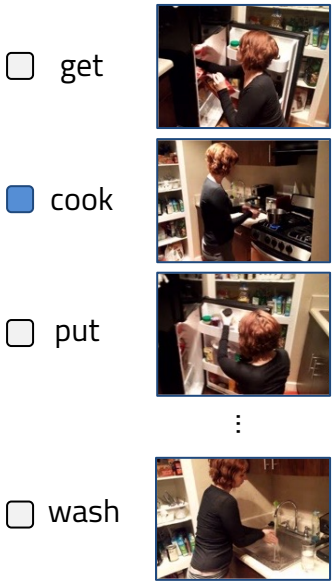
...

get cook put wash

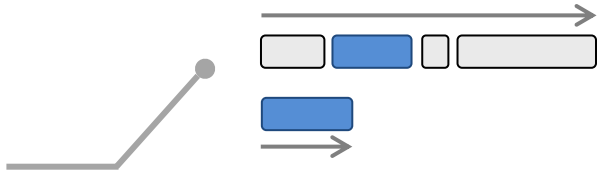
Atomic Action ~2 sec.

Complex Activity ~30 sec.

Properties of Complex Human Activities

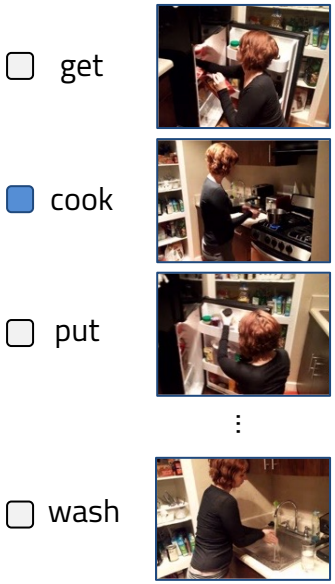


Cooking a Meal

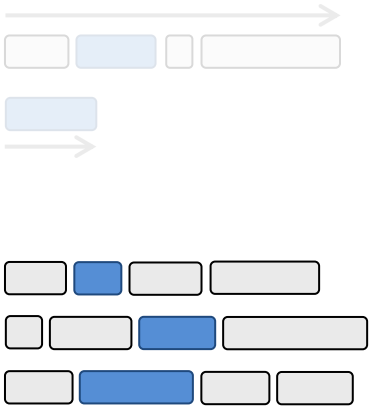


1. LONG-RANGE

Properties of Complex Human Activities



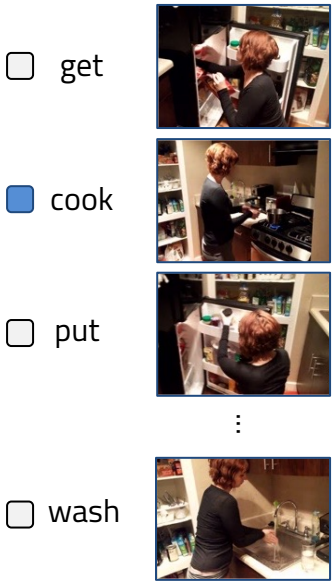
Cooking a Meal



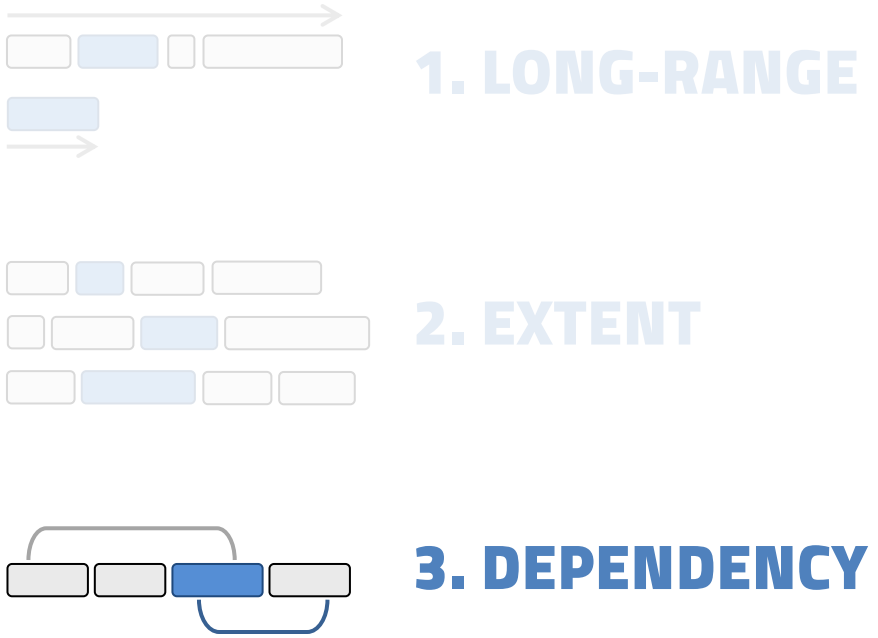
1. LONG-RANGE

2. EXTENT

Properties of Complex Human Activities



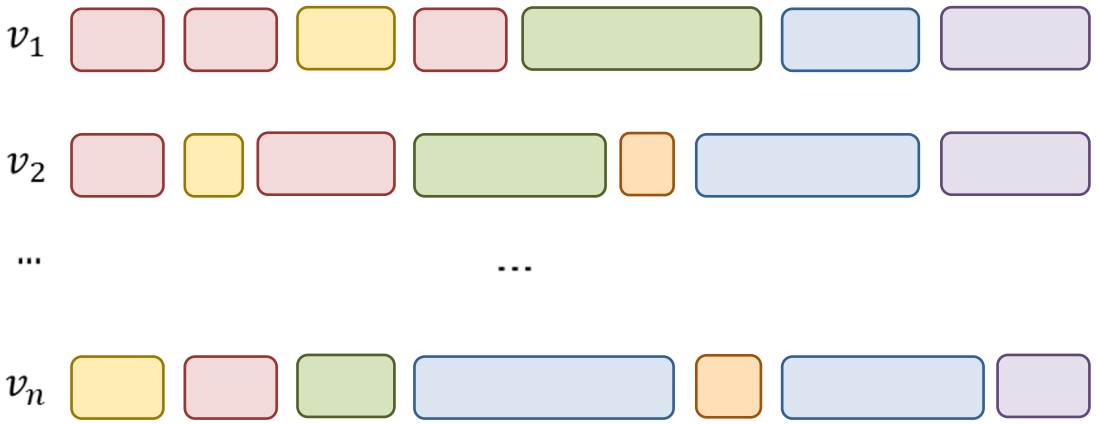
Cooking a Meal



Chapter Four

Graphical Structure of Time

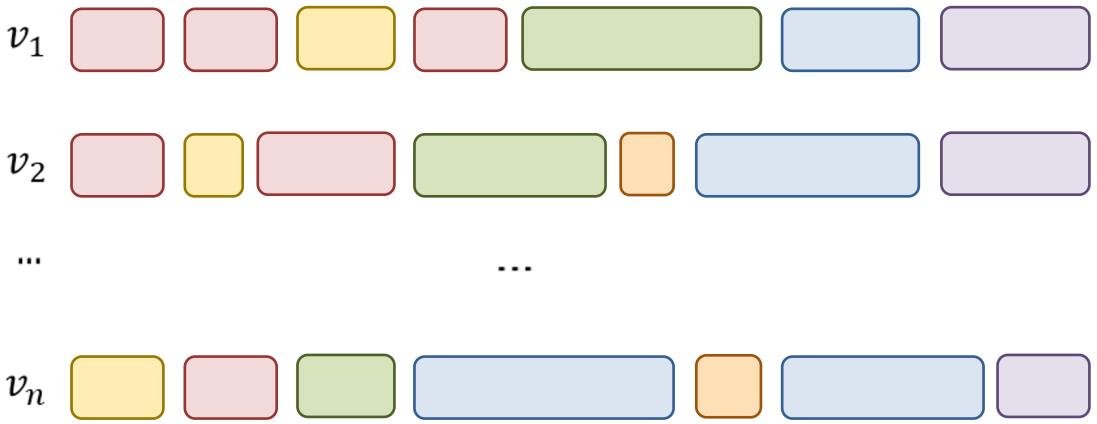
Time as a Graph



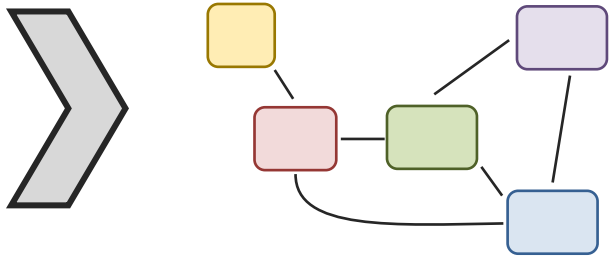
Video Examples of “Preparing Coffee”

- take cup
- pour coffee
- spoon sugar
- pour milk
- pour sugar
- stir coffee

Time as a Graph

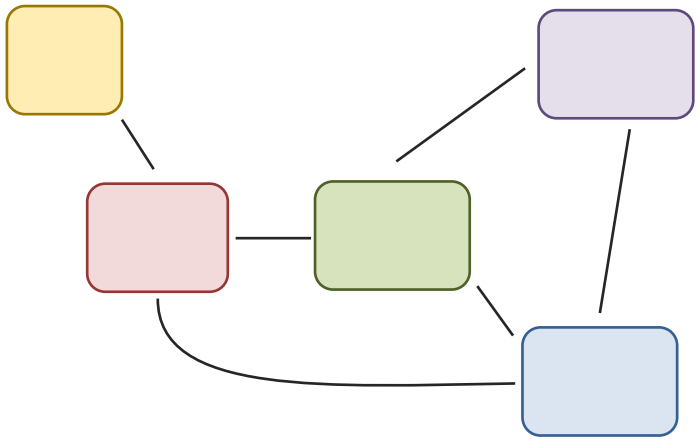


Video Examples of “Preparing Coffee”



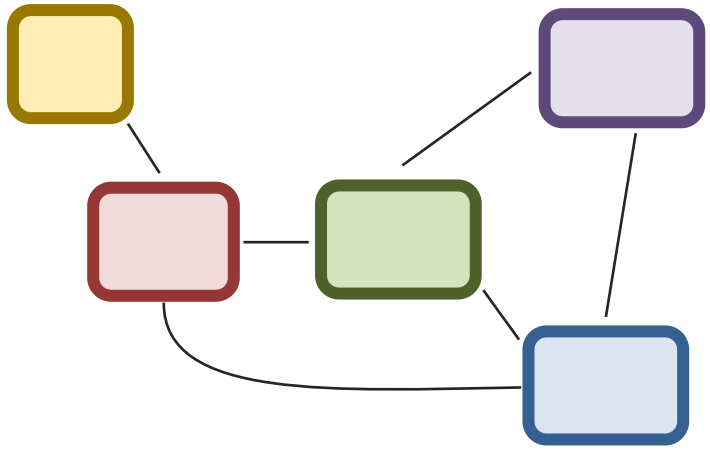
Graph Representation

Time as a Graph



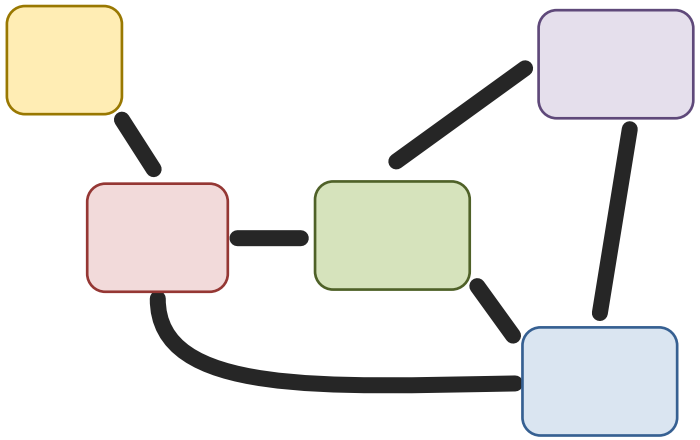
Graph Representation

Time as a Graph



Graph nodes represent core atomic actions

Time as a Graph



Graph edges represent spatial
and temporal relationships

Chapter Five

Permutation of Time

Temporal Pattern of Short-range Activities

High Jump (2 sec.)

run | run | jump | cross | fall

Temporal Pattern

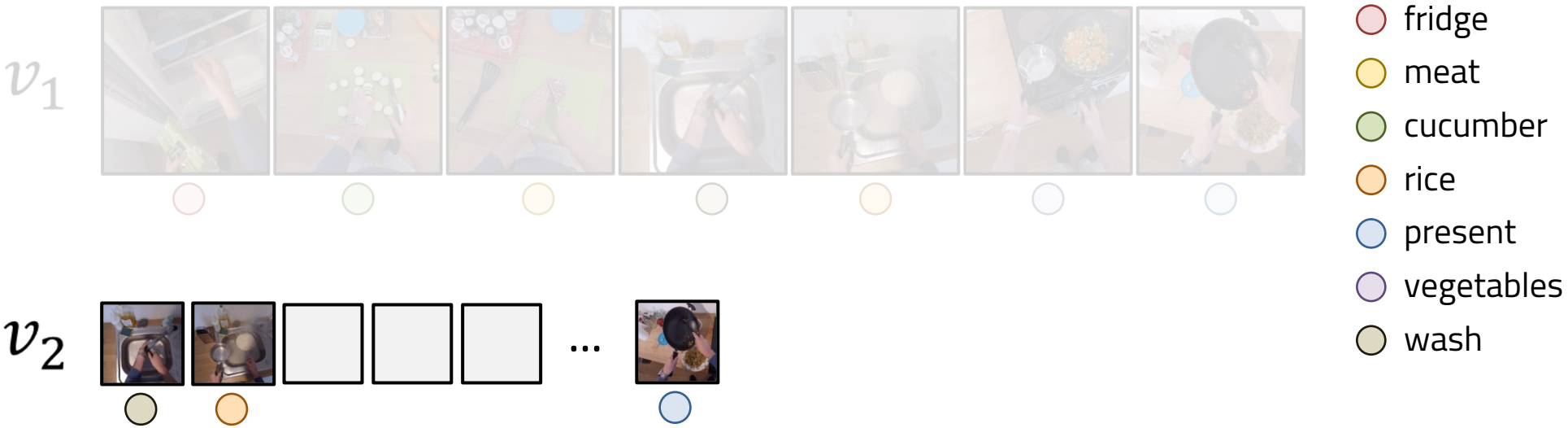
Invariance to Temporal Permutation

Preparing Dinner (5 min.)

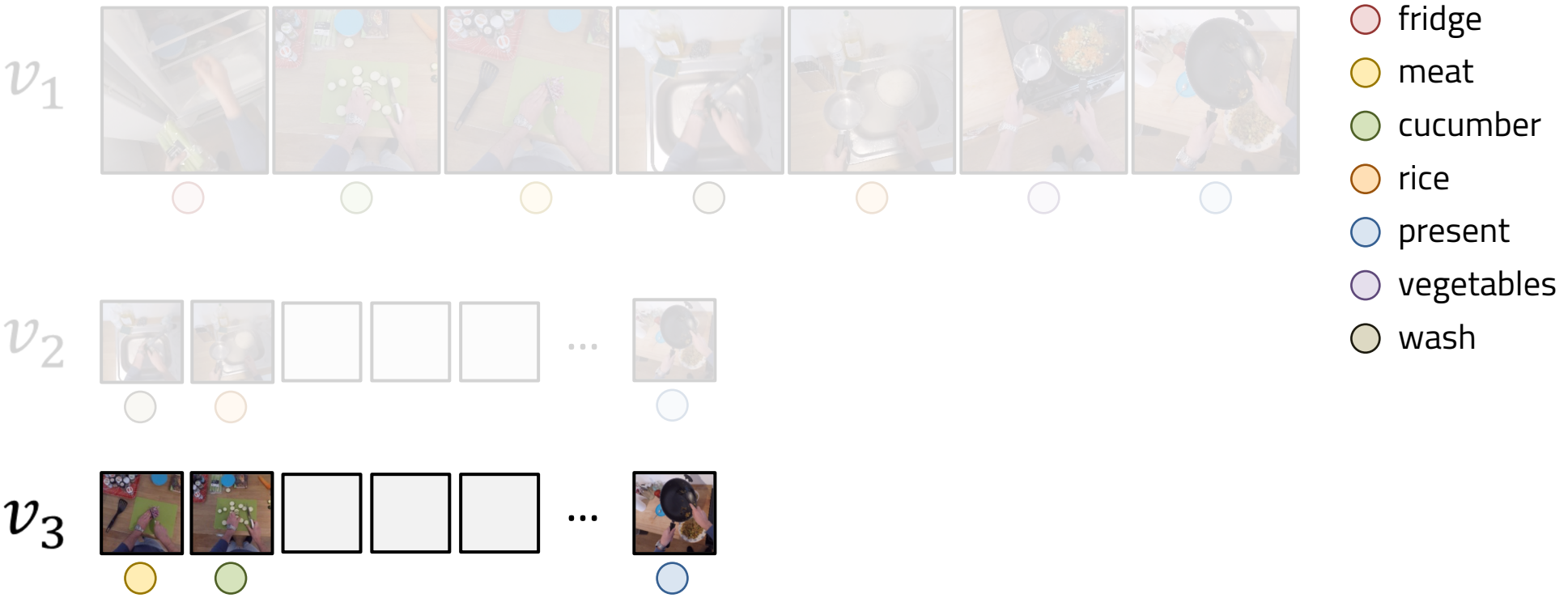
v_1

- fridge
- meat
- cucumber
- rice
- present
- vegetables
- wash

Invariance to Temporal Permutation



Invariance to Temporal Permutation



Chapter Six

Gating of Time

Temporal Gating for Efficient Recognition

Short-range Action: Disc Throw

Temporal Gating for Efficient Recognition

Short-range Action: Disc Throw

Temporal Gating for Efficient Recognition

Long-range Activity

Cook Food

Wash Dishes

Temporal Gating for Efficient Recognition

Long-range Activity

Cook Food

Wash Dishes

3

Conclusion

(1) Building **structure-aware** temporal modeling methods pays off.

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(2) Understanding of **temporal aspects** enables structure-ware modeling.

(1) Building **structure-aware** temporal modeling methods pays off.

(2) Understanding of **temporal aspects** enables structure-ware modeling.

(3) **Multi-modal** methods, **unsupervised** learning, and **uncurated** video datasets likely are the future.

Thank You