RHM:
Robot House Multi-view Human Activity Recognition Dataset

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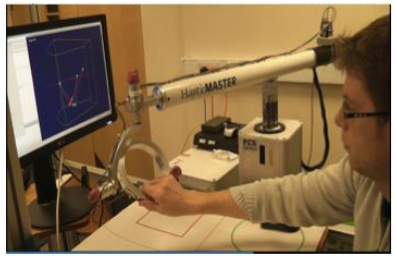
About Me

I am a PhD candidate in the Computer Science Department at the University of Hertfordshire. I research vision-based Human Action Recognition and deep learning. Also, I am a senior software engineer in the perception team at Conigital (an Autonomous Car company). My subjects are Robotics, Machine and Deep Learning, Robot Navigation, Vision Navigation, Computer Vision and IoT.

Robots in UH **Robot House** and Robotics Research Group



Robot House

Introduction

- **Human Robot Interaction**
  - **Care Robots**
    - **Human Action Recognition**
      - **Vision based models and datasets**

HAR Dataset Review

- Dynamic Perspective
  - (Robot View)
- Top View
  - (Fish-eye view)
- Redundancy
  - (Multi-view)

Dataset Name	Year	Video	An	Act	FV	En	Si	Mot	PoV	Modality	B	MV	AT	L	So	U	T	Acc
BON [33]	2022	2.6K	2.6K	18	_	Di	UC	Dy	FP	RGB	Dy	No	No	No	C	Home	Tr	No
EPIC-KITCHENS-100 [29]	2021	700	90K	4053	_	I	UC	Di	FP	RGB	Dy	No	No	No	C	Kitchen	A	Link
HOMAGE [28]	2021	5.7K	5.7K	75	2	I	UC	Di	FP/TP	12 Sensors	Dy	Yes	Yes	No	C	Home	A	Link
HA500 [34]	2021	10K	591K	500	_	Di	UC	St	TP	RGB	Dy	No	Yes	No	W	Diversity	A	Link
M-MiT [35]	2021	1M	2M	292	_	Di	UC	St	TP	RGB	Dy	No	No	Yes	W	Diversity	A	Link
MovieNet [36]	2020	1.1K	65K	80	_	Di	UC	St	TP	RGB	Dy	No	No	No	M	Diversity	A	Link
Multi-ViewPointOutdoor [37]	2020	2.3K	503K	20	3	O	UC	Di	TP	RGB	Dy	Yes	No	No	YT	Sport	A	No
HVU [38]	2020	572K	9M	3457	_	Di	UC	St	TP	RGB	Dy	No	No	No	YT	Diversity	A	Link
AViD [39]	2020	80k	80K	887	_	Di	C	St	TP	RGB	St	No	No	No	W	Diversity	A	Link
LEMMA [27]	2020	1.1K	0.9M	641	3	I	C	Di	FP/TP	RGB,D	Dy	Yes	Yes	No	C	Home	A	Link
InHARD [32]	2020	4.8K	2M	14	3	I	C	S	TP	RGB,D	Dy	Yes	No	No	C	Industrial	A	Link
FineGym [40]	2020	503	32.5K	15	_	I	UC	Di	TP	RGB	Dy	No	Yes	No	M	Sport	A	Link
Ava_Kinetic [22]	2020	500	230K	80	_	Di	UC	St	TP	RGB	Dy	No	No	Yes	YT	Diversity	A	Link
Kinetic_700_2020 [23]	2020	648K	648K	700	_	Di	UC	St	TP	RGB	Dy	No	No	No	YT	Diversity	A	Link
Jester [41]	2019	148K	5.3M	27	_	I	C	St	TP	RGB	Dy	No	Yes	No	C	Gesture	Tr	No
HACS [42]	2019	504K	1.5M	200	_	Di	UC	St	TP	RGB	Dy	No	No	Yes	YT	Diversity	A	Link
Kinetic_700 [21]	2019	650K	650K	700	_	Di	UC	St	TP	RGB	Dy	No	No	No	YT	Diversity	A	Link
NTU RGB+D 120 [18]	2019	114K	8M	120	155	I	C	St	TP	RGB,D	Dy	Yes	Yes	No	C	Daily	A	Link
MiT [43]	2019	1M	1M	339	_	Di	UC	Di	TP	RGB	Dy	No	No	No	W	Diversity	Tr	Link
20BN-sth_sth-V2 [25]	2018	220K	220K	174	_	I	UC	Di	FP	RGB	Dy	No	No	No	W	Diversity	A	No
Kinetic_600 [20]	2018	496K	496	600	_	Di	UC	Di	TP	RGB	Dy	No	No	No	YT	Diversity	A	Link
Charades-Ego [26]	2018	8K	68.5K	157	2	I	C	Di	FP/TP	RGB	Dy	Yes	Yes	Yes	C	Daily	A	Link
AVA [44]	2017	430	197K	80	_	Di	UC	St	TP	RGB	Dy	No	Yes	Yes	M	Diversity	A	Link
SLAC [45]	2017	520K	1.17M	200	_	Di	UC	Di	TP	RGB	Dy	No	No	Yes	YT	Diversity	A	No
MultiTHUMOS [46]	2017	38.6K	38.6K	65	_	Di	UC	Di	TP	RGB	Dy	No	No	No	W	Diversity	A	Link
20BN-Sth_Sth [24]	2017	100K	100K	174	_	I	UC	Dy	FP	RGB	Dy	No	Yes	No	W	Diversity	Tr	No
Kinetic_400 [19]	2017	300K	300K	400	_	Di	UC	St	TP	RGB	Dy	No	Yes	No	YT	Diversity	A	Link
M2I [47]	2017	1784	1784	22	2	I	C	St	TP	RGB,D	Dy	Yes	Yes	No	C	Diversity	Tr	No
DALY [48]	2016	8133	8133	10	_	Di	UC	St	TP	RGB	Dy	No	Yes	Yes	YT	Diversity	A	Link
YouTube-8M [16]	2016	8.2M	8.2M	4800	_	Di	UC	Di	TP	RGB	Dy	No	No	No	YT	Diversity	A	Link
NTU RGB+D [17]	2016	56K	56K	60	3	I	C	St	TP	RGB,D	Dy	Yes	Yes	No	C	Daily	Tr	Link
Charades [49]	2016	10K	10K	157	2	I	UC	St	TP	RGB	Dy	No	No	Yes	YT	Daily	Tr	Link
UTD-MHAD [50]	2015	861	861	27	5	I	C	St	TP	RGB,D	St	Yes	Yes	No	C	Daily	Tr	Link
ActivityNet [51]	2015	23K	23K	203	_	Di	UC	St	TP	RGB	Dy	No	No	No	W	Diversity	A	Link
Sport-1M [15]	2014	1M	1M	487	_	Di	UC	Di	TP	RGB	Dy	No	No	No	YT	Sport	A	Link
Berkeley MHAD [52]	2013	660	660	11	12	I	C	St	TP	RGB,D	St	Yes	Yes	No	C	Diversity	Tr	Link
Multi-View 3D Events [53]	2013	3.8K	383K	11	3	I	C	St	TP	RGB,D	Dy	Yes	Yes	No	C	Diversity	Tr	No
ASLAN [14]	2012	10K	10K	432	_	Di	UC	St	TP	RGB	Dy	No	No	No	YT	Diversity	Tr	Link
UCF101 [10]	2012	13K	13K	101	_	Di	UC	Di	TP	RGB	Dy	No	Yes	No	YT	Diversity	Tr	Link
LIRIS [31]	2012	828	828	10	2	I	C	Di	TP	RGB,D	Dy	Yes	Yes	Yes	C	Daily	Tr	Link
HMDB51 [7]	2011	6.8K	6.8K	51	_	Di	UC	Di	TP	RGB	Dy	No	No	No	YT	Daily	Tr	Link
UCF_ARG [12]	2010	480*3	480*3	10	3	O	C	St	TP	RGB	Dy	Yes	Yes	Yes	C	Daily	Tr	Link

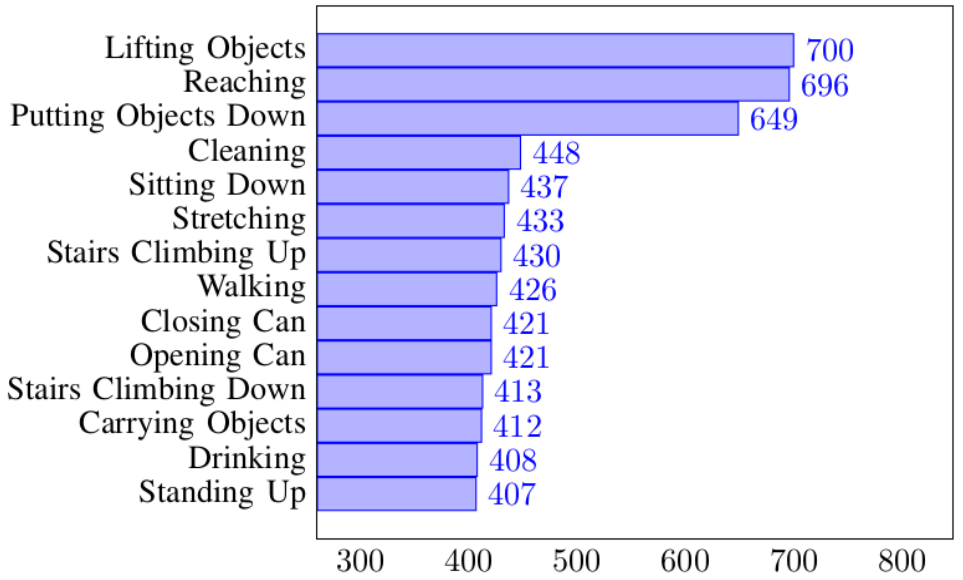
Robot House Multiview Dataset

- **Camera Types and Viewpoints**
  - Static – Front
  - Static – Back
  - Fisheye – Top
  - Dynamic - Robot
- **Subject**
  - One Person
- **Content**
- **Training-Validation-Testing**

(Video Number)	Train	Validation	Test	Total
Each View	4278	1076	1347	6701
All Views	17112	4304	5388	26804

- **Naming Protocol**
  - ClassName_ViewName_clipNumber.avi
- **Time Synchronizing**
- **RHM Skeleton dataset and Analysis**

View Name	Motion	Position	Resolution	FR
FrontView	Static	Wall	640 * 480	30
BackView	Static	Wall	640 * 480	30
RobotView	Dynamic	Robot	640 * 480	30
OmniView	Static	Ceiling	512 * 486	30



Robot House Multiview Dataset

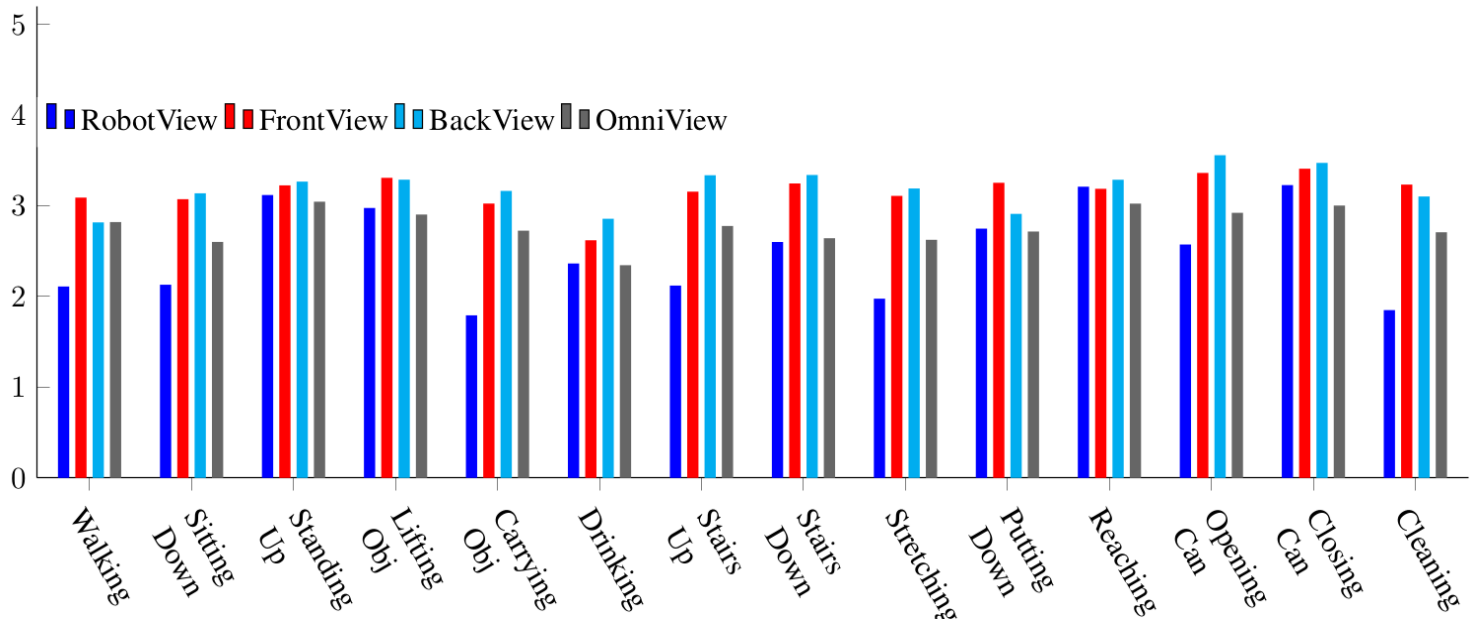
RHM Dataset Analysis

- Mutual Information
- Deep models Analysis

$$I(X;Y) = \sum_{x,y} P(x,y) \log \frac{P(x,y)}{P(x)P(y)}$$

$$MI(f_i, f_m) = \sum_{i=1}^{m} P(f_i, f_{i+1}) \log \frac{P(f_i, f_{i+1})}{P(f_i)P(f_{i+1})}$$

$$Ave_{mi} = \frac{1}{m-1} MI(f_i, f_m)$$



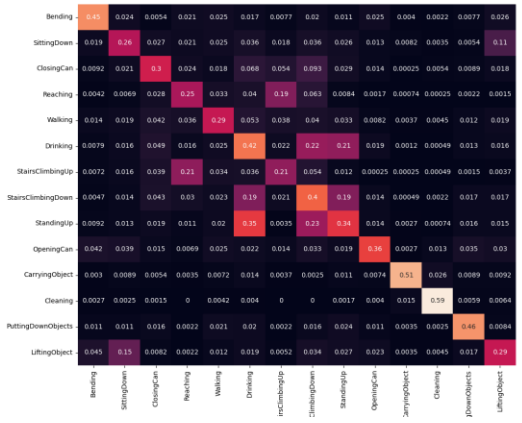
Deep Model Metrics

- Top-1 Accuracy
  - is the conventional accuracy, model prediction (the one with the highest probability) must be exactly the expected answer.
- Top-5 Accuracy
  - means any of our model's top 5 highest probability answers match with the expected answer.

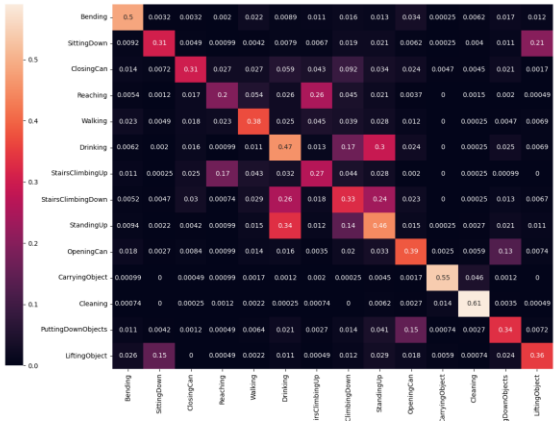
RHM Dataset Analysis

- Mutual Information
- Deep models Analysis

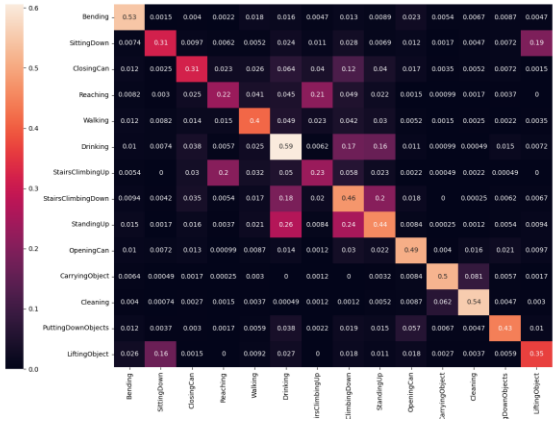
	Robot View		Front View		Back View		Omni View		Kinetic 400	
Model	Top1	Top5	Top1	Top5	Top1	Top5	Top1	Top5	Top1	Top5
C3D [55]	55.53	93.83	**70.3**	**97.85**	69.48	97.84	67.48	97.69	71.4	NA
R3D [56]	61.98	94.28	69.04	**97.55**	69.33	97.4	**69.71**	97.25	74.4	91
R2+1D(RGB) [56]	55.6	91.9	65.79	95.91	**66.96**	**96.58**	64.73	95.99	72	90
Slow-Fast(8*8-R50) [57]	55.15	91.61	62.28	**97.25**	**63.62**	96.43	60.65	96.51	77	92.6
Slow-Fast(8*8-R101) [57]	58.57	92.79	59.39	**96.51**	60.43	95.61	**61.76**	96.36	77.9	93.2



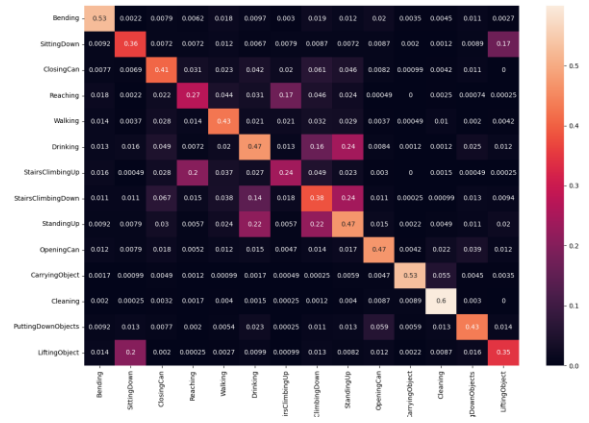
Robot View



Front View

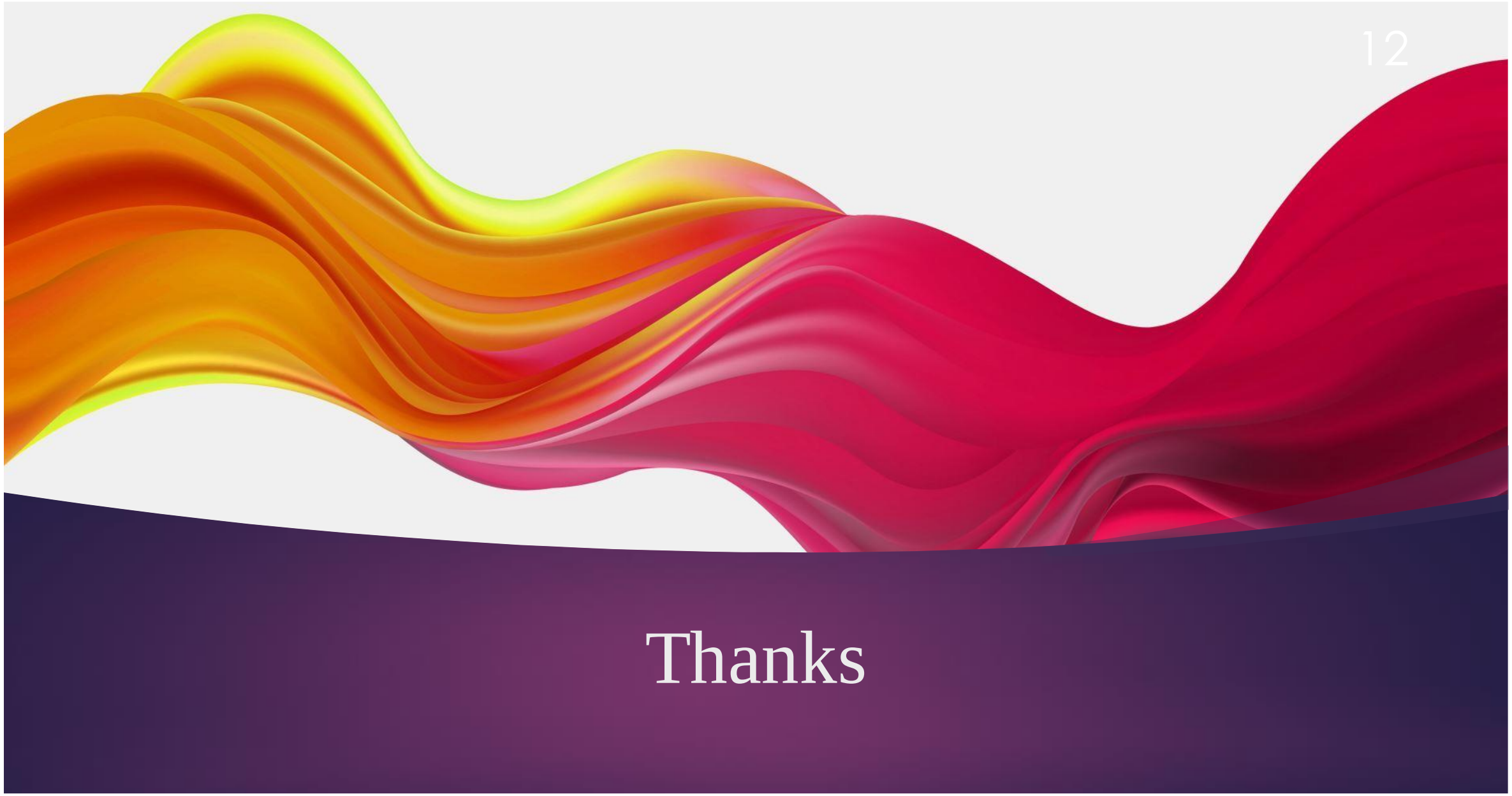


Back View



Top View

Uniqueness and Limitation



Thanks