

Foundations Models Have Great Performance!



A photo of a dog.



A photo of a kite.



The man at bat ready to swing at the pitch while the umpire looks on.



A horse carrying a large load of hay and two people sitting on it.

Will It Work on Your Data?

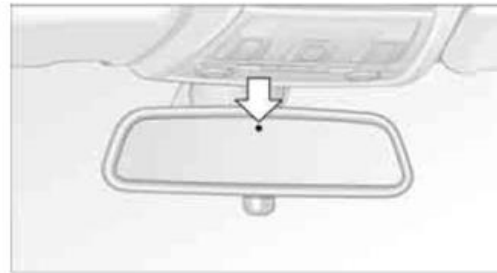
Probably Not Good Enough 😞

Interior rearview mirror



Turn the knob to reduce glare from the headlamps of cars behind you when driving at night.

Interior and exterior mirrors, automatic dimming feature



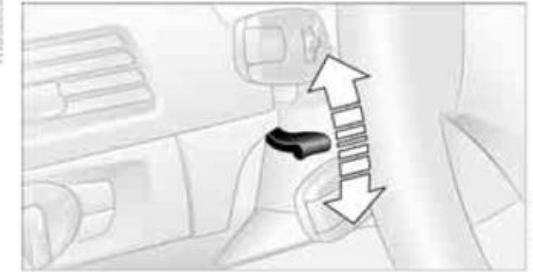
The automatic dimming feature of the interior and exterior mirrors is controlled by two photo cells in the interior rearview mirror. One photo cell is in the mirror frame, see arrow; the other is on the back of the mirror.

In order to ensure that the system functions correctly, keep the photo cells clean, do not cover the area between the interior rearview mirror and windshield, and do not affix adhesive labels or stickers of any kind to the windshield directly in front of the mirror.

Steering wheel

Adjustments

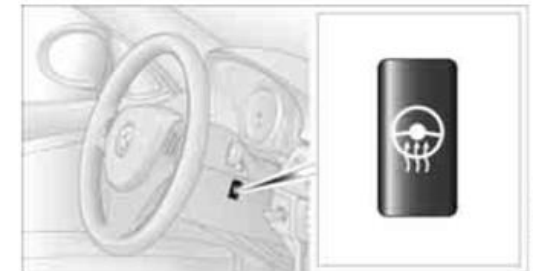
⚠ Do not adjust the steering wheel position while the car is in motion; otherwise, there is a risk of an accident due to unexpected movement. ◀



1. Fold the lever down.
2. Move the steering wheel to the preferred height and angle to suit your seated position.
3. Swing the lever back up.

⚠ Do not use force to swing the lever back up; otherwise, the mechanism will be damaged. ◀

Steering wheel heating



Press the button.

The LED in the button lights up when the steering wheel heating is switched on.

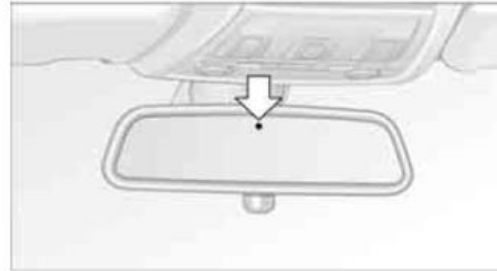
We Have an Easy Solution 😊

Interior rearview mirror



Turn the knob to reduce glare from the headlamps of cars behind you when driving at night.

Interior and exterior mirrors, automatic dimming feature



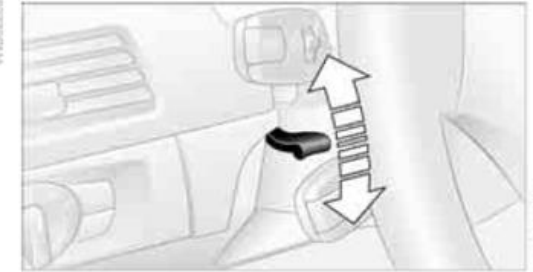
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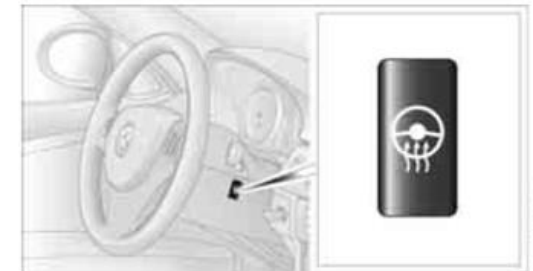
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FETA: Towards Specializing Foundation Models for Expert Task Applications

Amit Alfassy^{1,2*}, Assaf Arbelle^{1*},

Oshri Halimi^{1,2}, Sivan Harary¹, Roei Herzig¹, Eli Schwartz¹,

Rameswar Panda¹, Michele Dolfi¹, Christoph Auer¹, Kate Saenko^{1,3}, Peter Staar¹, Rogerio Feris¹, Leonid Karlinsky^{1*}

¹IBM Research, ²Technion- Israel Institute Of Technology, ³Boston University

**Equal Contribution*



2022 FMs vs Today

- In 2022 CLIP was SOTA.
- FETA's method can use any base model and hopefully improve it.

FETA Overview

IMAGENET



A photo of a dog.



A photo of a kite.

COCO
Common Objects in Context



The man at bat readies to swing at the pitch while the umpire looks on.



A horse carrying a large load of hay and two people sitting on it.

- FMs (V&L) Models/ datasets, focus and excel on real common images (left).



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COCO
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- FMs performs poorly on some expert data.


Controls
Adjustments

Interior rearview mirror



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Steering wheel

Adjustments

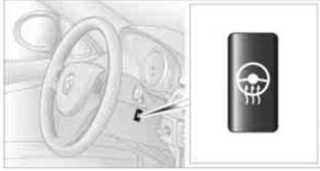
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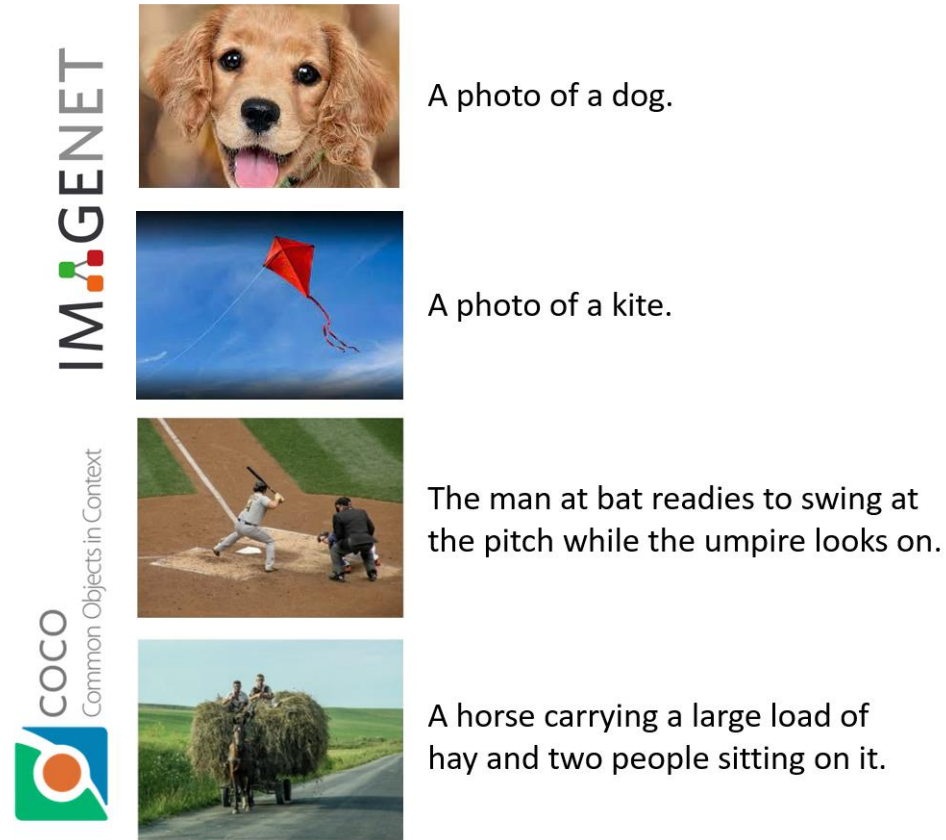
Steering wheel heating



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FETA Overview



Text 1 Controls Adjustments

Text 2 Interior rearview mirror

Image 1

Text 3 Turn the knob to reduce glare from the headlamps of cars behind you when driving at night.

Image 2

Text 4 The automatic dimming feature of the interior and exterior mirrors is controlled by two photo cells in the interior rearview mirror. One photo cell is in the mirror frame, see arrow; the other is on the back of the mirror.
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Text 5 Steering wheel Adjustments
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Image 3

Text 6 1. Fold the lever down.
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Do not use force to swing the lever back up; otherwise, the mechanism will be damaged.

Image 4

Text 7 Press the button.
The LED in the button lights up when the steering wheel heating is switched on.

- FMs (V&L) Models/ datasets, focus and excel on real common images (left).
- FMs performs poorly on some expert data.
- We propose an **AUTOMATIC** pipeline for extracting expert data from documents.
- We offer FETA's MIL-CLIP learn from documents' pages (right).

FETA Datasets – Real World Expert Data

100% **automatic** annotation process for any document.

IKEA data

The NEVER ENDING job

We have decided to help create a world where we take better care of the environment, the earth's resources and each other. We know that sometimes we are part of the problem. So, we are working hard to become a part of the solution. We are weighing the pros and cons, continually examining and changing things. All these steps, in lots and lots of areas, add up to something big... and noticeable. The job has already started, and it is a never-ending one. Follow our progress at IKEA-USA.com/theneverendinglist

#24 IMPROVEMENT: All plastic bottles could become curbside recycling. The smart and stylish? PLIS2018 water paper bottles are made from 100% recycled PET plastic.



#49 IMPROVEMENT: The soft, already woven fabric in IKEA 3054 KOPP bed linen is more than 80% cotton and 20% Tencel. Tencel is a renewable natural material also made from wood chips from local farms. It has low water stain, carbon levels. Also, the reversible cover has the same producer green as we received in a closed system to minimize environmental impact and waste.



#29 IMPROVEMENT: For every reusable lamp sold, IKEA Social Initiative donates a lamp to a child and saves the children's future to help them play, read, write and study after dark. So far, over 30,000 lamps have been sold. SUNNAN uses low-voltage LEDs that transform sunlight into electrical energy and require no electrical connection. Just charge the solar for 4-12 hours to detect bright light. Adults and get three hours of full brightness. You can use SUNNAN indoors.



#16 IMPROVEMENT: The ultra-thin, made-from-a-string felt lightings... instead using a very efficient production technique. Use HÖV, a thin, transparent paper film, which is 100% different from other materials and makes it easier to transport.

#68 IMPROVEMENT: The manufacturing of plastic bottles can consume large amounts of water and gas. Today, 88% of 2000 covered bottles produced by HANÅS BOTTLE (SWE) are produced with technology that requires less water and energy. The result? Better quality bottles as the fabric is softer than a regular one. In addition, color-fastness is more durable, making it particularly useful for children's bedding, which requires more washing.



#15 IMPROVEMENT: The round, weather-resistant, latest IKEA products made from wood-based frames. They contain recycled, bamboo-based paper—a fabrication of fibers for its strength and rigidity. IKEA uses low raw material from particleboard. It is now made lightweight and thus easier to handle during transportation and for use at home.





ULTIMOPPER \$599 ÖRTÖPPER sofa \$599 Callen. The ÖRTÖPPER sofa is made of renewable cover, imported. It is made of 100% recycled polyester. It is made of 100% recycled polyester. It is made of 100% recycled polyester.

#13 IMPROVEMENT: To reduce packaging in transport and store our beds, ÖRTÖPPER sofa is a good solution and environmentally sound material. We recently made ÖRTÖPPER a customer assembly piece, and now it's packed in a way that... makes space needed for transport and washing up by rail. Each ÖRTÖPPER sofa now fits into an easy-to-use, which has made it easier to... take the sofa home with improved sustainability and increased quality.

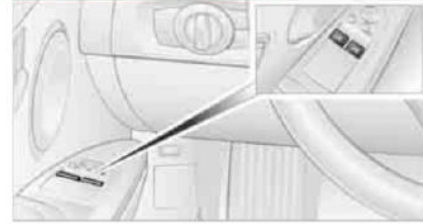
Car-Manuals data

Controls Opening and closing

 The warning lamp in the instrument cluster lights up while the engine is running: the remote control is no longer inside the vehicle. After the engine is switched off, the engine can only be restarted within approx. 10 seconds.

 The indicator lamp in the instrument cluster lights up and a message appears on the Control Display: replace the battery in the remote control.

Coupe: opening, closing



Replacing the battery
The remote control for Comfort Access contains a battery that will need to be replaced from time to time.

1. Take the integrated key out of the remote control, refer to page 30.


- ▶ Press the switch to the resistance point: The window opens as long as you press the switch.
 - ▶ Press the switch beyond the resistance point: The window opens automatically. Press the switch again to stop the opening movement.
- You can close the windows in the same manner by pulling the switch.



Convertible: opening, closing


Individually



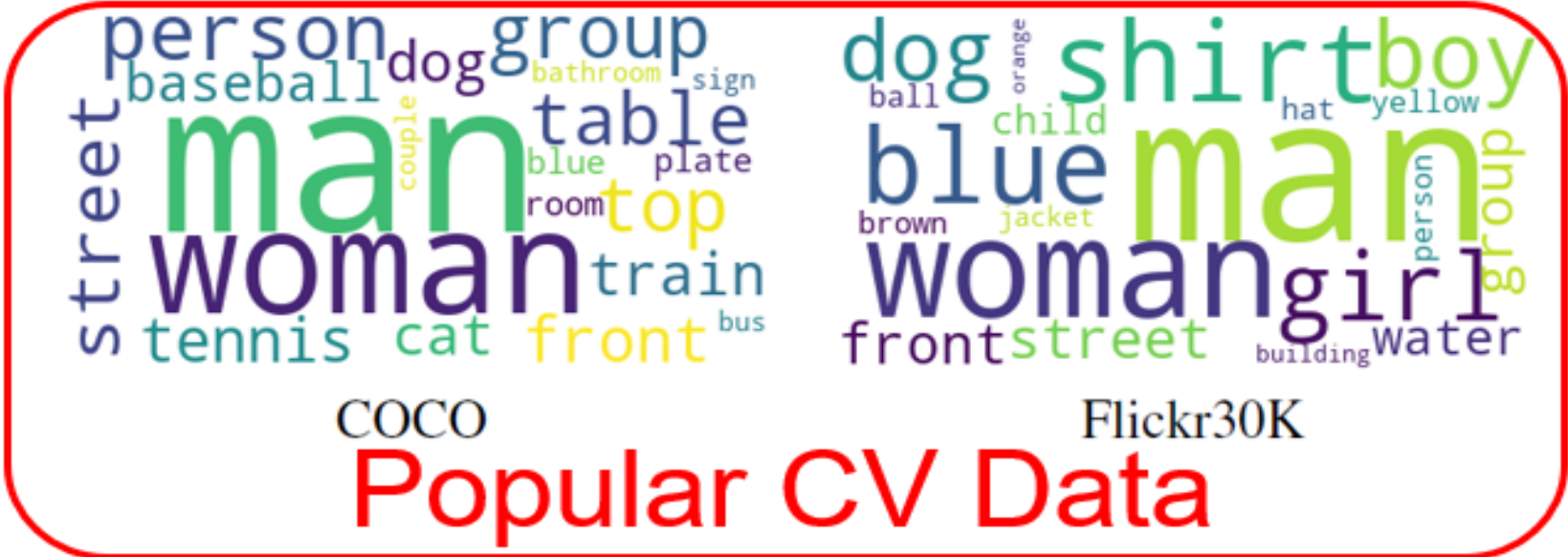
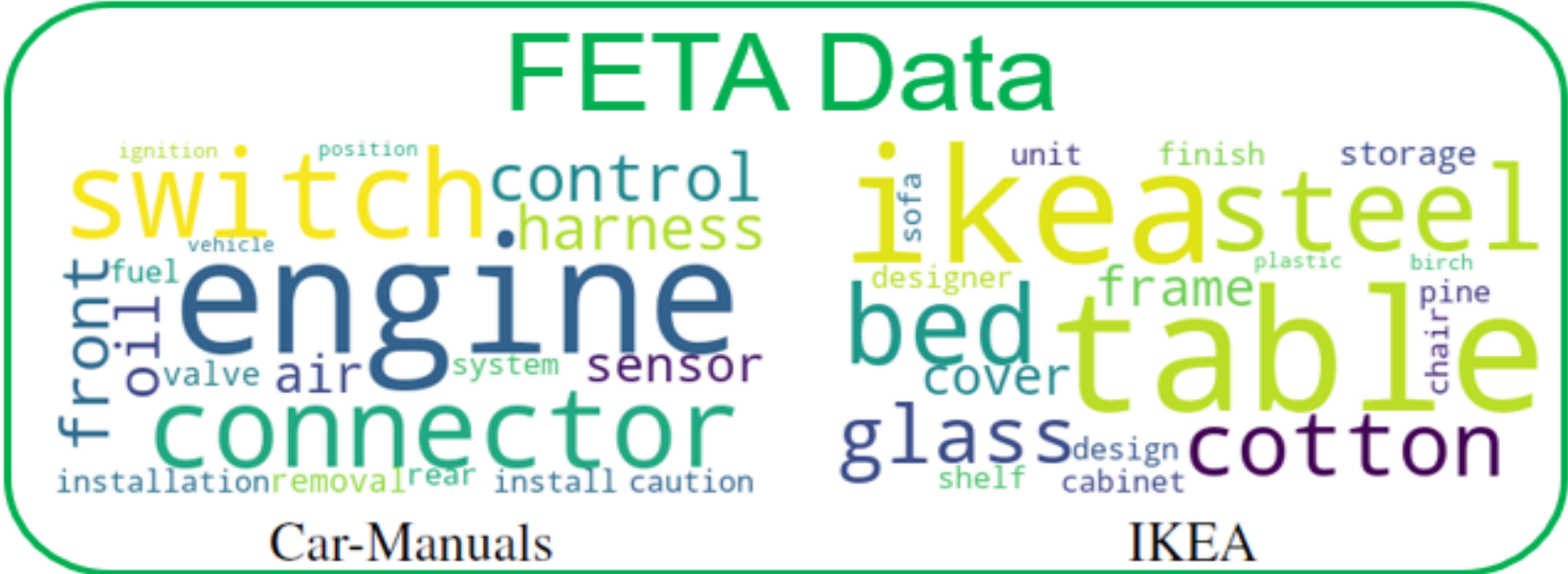
2. Remove the cover.
 3. Insert the new battery with the plus side facing up.
 4. Press the cover on to close.
-  Dispose of the old battery at a collection point or at your BMW center. ◀

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Windows


 To prevent injuries, watch the windows while closing them. Take the remote control with you when you leave the car; otherwise, children could operate the electric windows and possibly injure themselves. ◀


Expert Data
Common Nouns-
Greatly Differ
From Popular
CV Data:



Training With Automatically Annotated Documents

- CLIP requires one-to-one matching between image and text learn.
- Our automatic pipeline creates one-to-many Image-texts bags.

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MIL-CLIP: Image-Texts Bags



Positive texts bag

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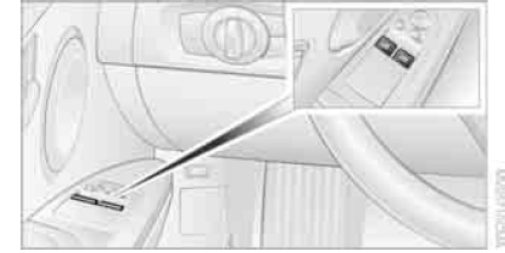
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
Negative texts bag

Locking the passenger belt

Lock the passenger belt to install a child restraint system.


Insert key and push in.

Keep key pushed in and turn it until reaching the stop at the  position. Pull key out at this stop.

 After removing the key, make sure that the switch is in the  position; otherwise, the locking action on the safety belt is not guaranteed. ◀

Ignition on

All electrical consumers can operate. The odometer and trip odometer are displayed in the instrument cluster.

 When the engine is off, please switch off the ignition and any unnecessary electrical consumers in order to preserve the battery. ◀

CLIP-MIL Max Loss

Choose text with maximal similarity from the positive bag



Positive texts bag

Convertible: opening, closing

0.3

Individually

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0.55

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0.15



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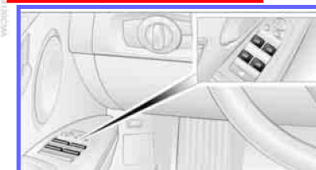


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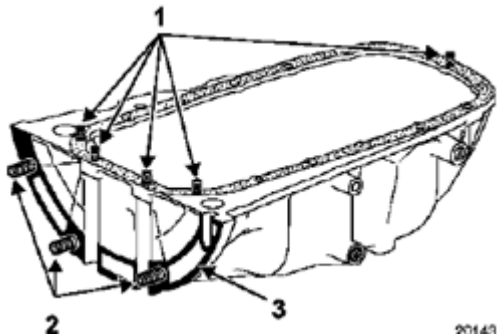


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Baselines

1. Concatenate (ours): merge all page texts.



REFITTING METHOD

Fit the gasket on the sump using five bolts (1).

Refit:

- the sump on the cylinder block by tightening all the bolts **without locking them**,
- the three bolts (2) joining the sump to the clutch housing **without locking them**.

Place the edge (3) of the oil sump against the clutch housing.

Tighten the 17 bolts on the oil sump to a torque of **1 daNm** in the recommended order.

Check that all the bolts are correctly tightened to **1 daNm**.

Tighten the three bolts (2) joining the sump to the clutch housing to a torque of **4 daNm**.

Top up the engine oil.

Refit in the reverse order to removal.

ENGINE AND PERIPHERALS Sump

10

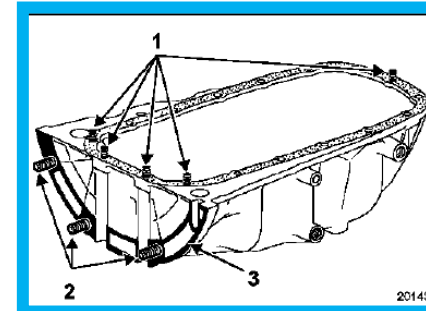
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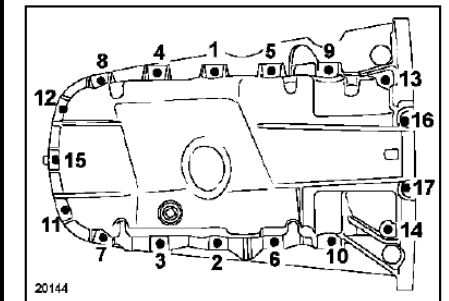
Refit:

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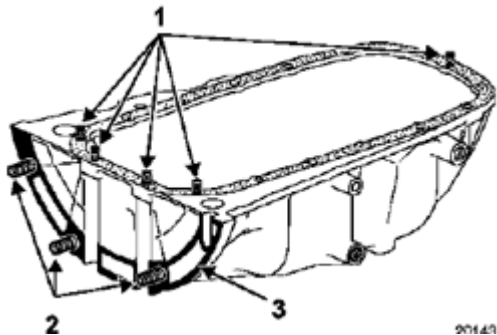
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2. Choose-One (ours): randomly select one text from each page.



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ENGINE AND PERIPHERALS Sump

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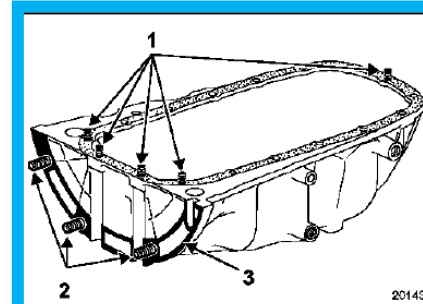
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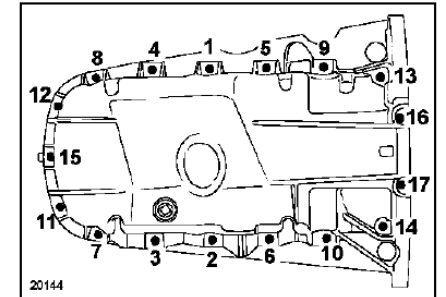
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Refit in the reverse order to removal.

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3. CLIP, Radford et al. ICML 21.
4. FLAVA, Singh et al. 22.
5. ALBEF, Li et al. NEURIPS 21.
6. Vilt, Kim et al. ICML 21.

ENGINE AND PERIPHERALS
Sump

10

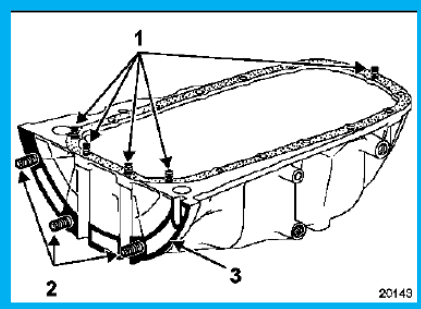
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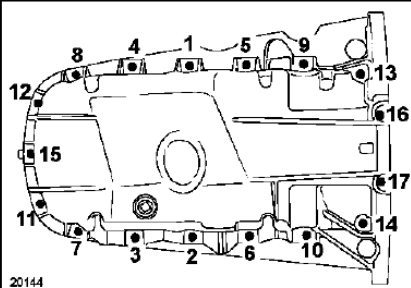
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Place the edge (3) of the oil sump against the clutch



20143

Tighten the 17 bolts on the oil sump to a torque of 1 daNm in the recommended order.



20144

Check that all the bolts are correctly tightened to 1 daNm.

Tighten the three bolts (2) joining the sump to the clutch housing to a torque of 4 daNm.

Top up the engine oil.

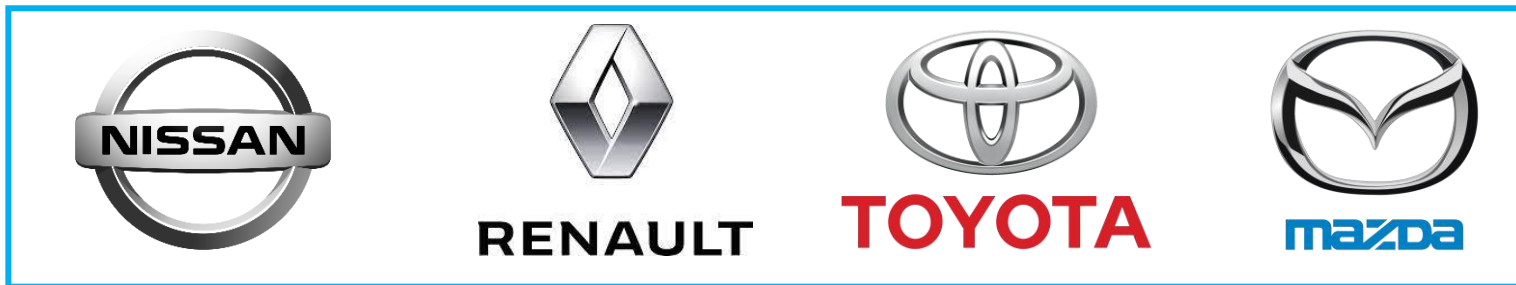
Refit in the reverse order to removal.

Experimental Setting – Car-Manuals Data

5 folds, one for each car manufacturer were used for all experiments.

- i. Zero-Shot: Leave one manufacturer out.

Train on



Test on

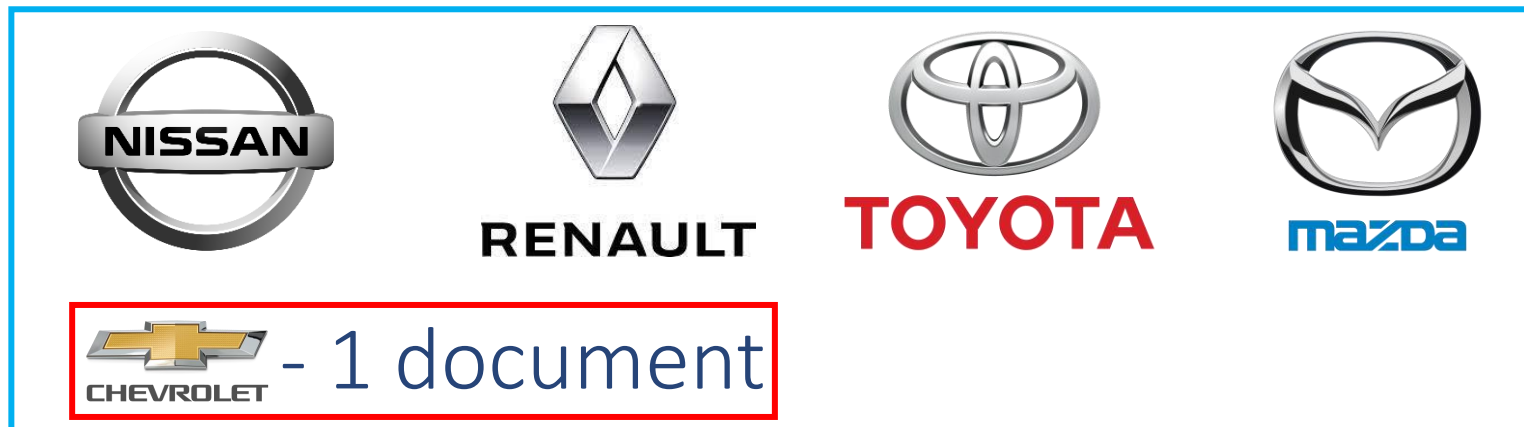


Experimental Setting – Car-Manuals Data

5 folds, one for each car manufacturer were used for all experiments.

- i. Zero-Shot: Leave one manufacturer out.
- ii. One-Shot: Same as Zero-shot + 1 document from test manufacturer.

Train on



Test on

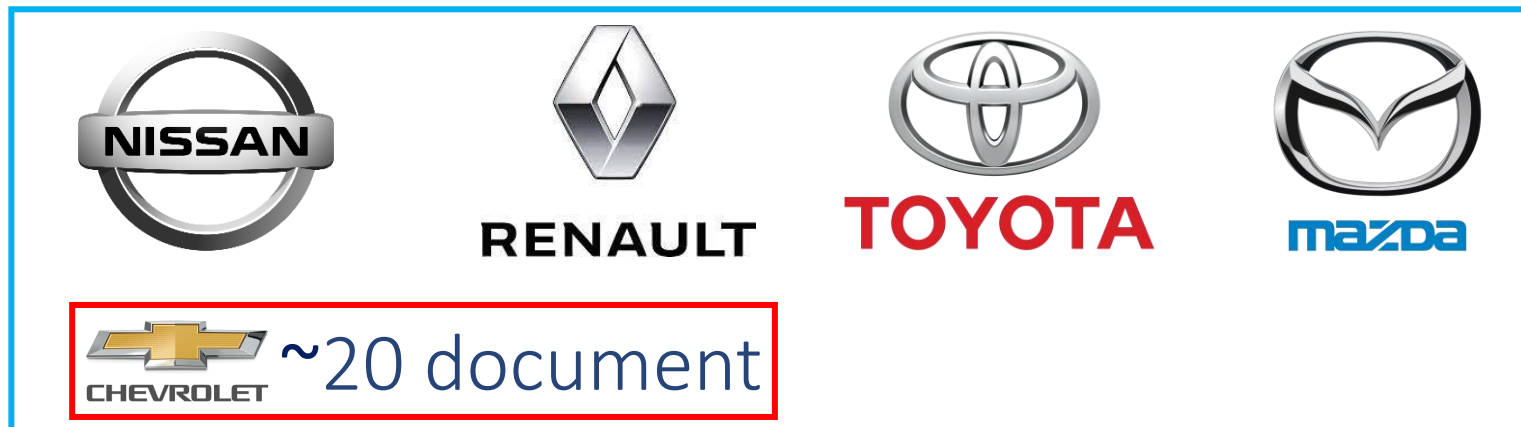


Experimental Setting – Car-Manuals Data

5 folds, one for each car manufacturer were used for all experiments.

- i. Zero-Shot: Leave one manufacturer out.
- ii. One-Shot: Same as Zero-shot + 1 document from test manufacturer.
- iii. Few-Shot: ~20 documents instead of 1.

Train on



Test on



Experimental Setting – Car-Manuals Data

5 folds, one for each car manufacturer were used for all experiments.

- i. Zero-Shot: Leave one manufacturer out.
- ii. One-Shot: Same as Zero-shot + 1 document from test manufacturer.
- iii. Few-Shot: ~20 documents instead of 1.
- iv. Many-Shot: ~200 documents instead of 1.

Train on



Test on



Car Manuals Data Retrieval Results

25%
performance
boost

		Image-to-Text			Text-to-Image			
	Name	Locked	Rec@1	Rec@5	Rec@10	Rec@1	Rec@5	Rec@10
Zero-Shot	CLIP		9.7%	26.6%	38.1%	10.1%	26.7%	39.5%
	FLAVA		4.0%	16.6%	29.7%	5.5%	19.8%	34.5%
	ViT		2.9%	11.5%	22.0%	3.5%	14.3%	26.7%
	ALBEF		3.9%	16.6%	26.7%	4.4%	18.4%	31.2%
	Concatenate	✓	9.4%	25.0%	36.7%	8.1%	24.0%	37.6%
	Choose-One	✓	10.40%	26.7%	39.3%	9.20%	25.6%	37.9%
	CLIP-MIL	✓	11.0%	29.2%	40.0%	9.7%	28.1%	40.6%
One-Shot	CLIP		9.7%	26.6%	38.1%	10.1%	26.7%	39.4%
	FLAVA		4.0%	16.6%	29.7%	5.5%	19.8%	34.5%
	ViT		2.9%	11.5%	22.0%	3.5%	14.3%	26.7%
	ALBEF		3.9%	16.6%	26.7%	4.4%	18.4%	31.2%
	Concatenate	✓	8.7%	24.4%	37.0%	7.9%	25.1%	38.5%
	Choose-One	✓	10.4%	28.0%	39.9%	8.9%	25.5%	37.9%
	CLIP-MIL	✓	11.9%	30.3%	42.5%	10.9%	29.4%	43.2%
Few-Shot	CLIP		8.6%	25.6%	37.2%	9.2%	24.3%	36.6%
	FLAVA		3.9%	16.7%	30.1%	5.2%	18.5%	32.7%
	ViT		2.8%	11.1%	21.6%	3.2%	13.3%	25.4%
	ALBEF		3.9%	13.1%	25.5%	4.2%	17.4%	29.6%
	Concatenate	✓	8.4%	24.5%	38.5%	10.5%	29.0%	41.8%
	Choose-One	✓	11.6%	31.5%	44.7%	11.6%	29.0%	44.0%
	CLIP-MIL	✓	13.8%	33.7%	47.5%	11.6%	33.0%	47.0%
Many-Shot	CLIP		13.8%	31.2%	41.6%	13.6%	36.4%	50.7%
	FLAVA		4.2%	16.1%	27.8%	6.6%	24.4%	41.0%
	ViT		3.1%	13.3%	23.4%	4.4%	18.3%	32.0%
	ALBEF		3.8%	15.8%	26.6%	5.5%	22.4%	37.5%
	Concatenate	✓	20.7%	39.7%	51.3%	16.2%	41.2%	56.2%
	Choose-One	✓	27.7%	52.7%	64.1%	21.6%	52.1%	66.5%
	CLIP-MIL	✓	34.5%	56.8%	66.1%	27.2%	57.9%	70.7%

Manually Annotated Data

- We manually annotated a subset of the documents.
- The results validate the results of the automatically annotated data.

		Image-to-Text			Text-to-Image			
	Name	Locked	Rec@1	Rec@5	Rec@10	Rec@1	Rec@5	Rec@10
Zero-Shot	CLIP		14.3%	39.3%	55.6%	14.7%	36.4%	57.0%
	Concatenate	✓	9.3%	35.4%	58.5%	11.7%	31.5%	51.5%
	Choose-One	✓	12.8%	40.5%	59.0%	14.2%	41.9%	60.0%
	CLIP-MIL	✓	13.9%	41.0%	65.0%	15.1%	43.2%	60.8%
One-Shot	CLIP		14.3%	39.3%	55.6%	14.7%	36.4%	57.0%
	Concatenate	✓	12.4%	37.7%	54.1%	13.0%	35.3%	54.9%
	Choose-One	✓	12.4%	38.8%	62.5%	14.2%	39.5%	62.1%
	CLIP-MIL	✓	15.8%	39.9%	62.6%	14.9%	41.6%	62.5%
Few-Shot	CLIP		12.8%	37.3%	51.7%	12.5%	32.1%	53.0%
	Concatenate	✓	8.2%	33.0%	55.4%	8.8%	28.9%	51.3%
	Choose-One	✓	9.8%	37.0%	59.5%	10.1%	35.7%	59.7%
	CLIP-MIL	✓	12.9%	38.4%	60.3%	13.2%	38.6%	61.6%
Many-Shot	CLIP		20.0%	47.2%	71.3%	23.7%	53.4%	72.9%
	Concatenate	✓	29.9%	61.6%	81.1%	28.8%	56.4%	76.3%
	Choose-One	✓	34.6%	70.6%	83.5%	33.7%	68.3%	82.6%
	CLIP-MIL	✓	43.0%	74.8%	85.7%	43.5%	70.2%	85.3%

Parameter Locking and LoRA Ablation

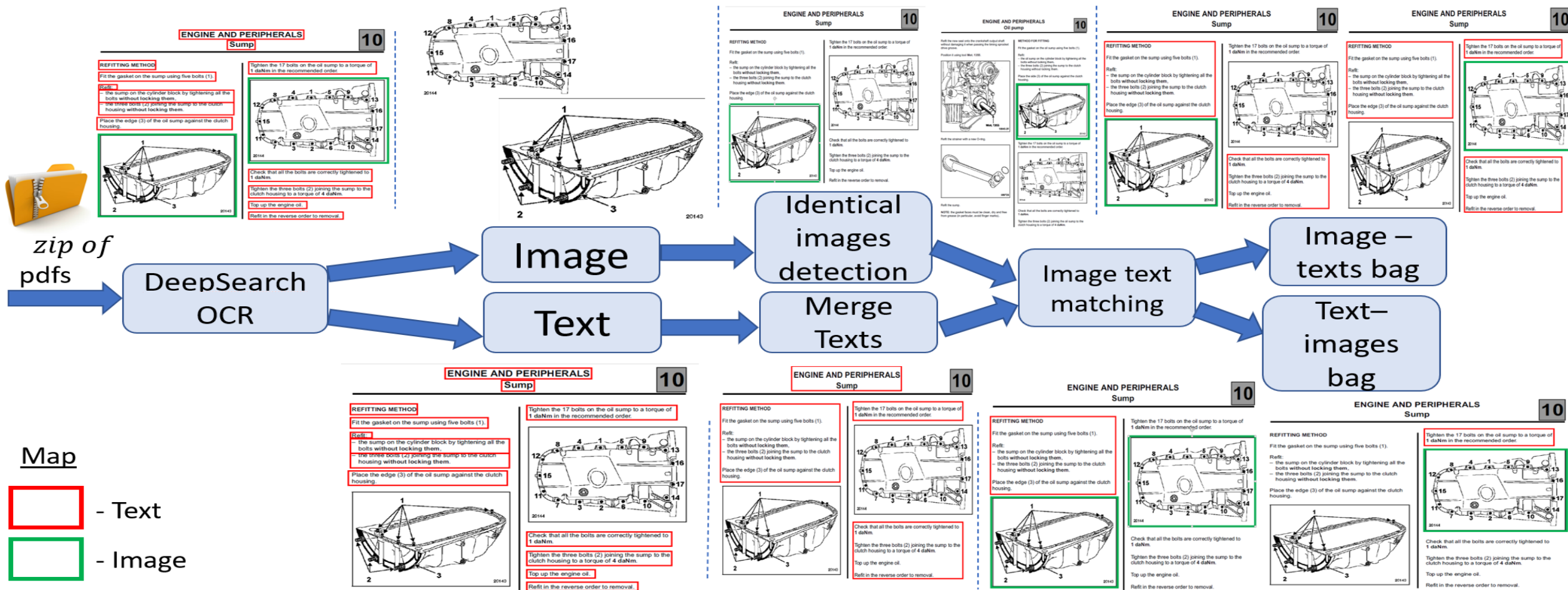
- CLIP 400M finetuned while locking different parts of the network.
- We use LoRA to interpolate between the Unlocked (rank $r = 512$) and the Locked Image (rank $r = 0$) variants.
- Many-Shot results:

Baseline	Locking	Image-to-Text			Text-to-Image		
		Rec@1	Rec@5	Rec@10	Rec@1	Rec@5	Rec@10
CLIP-MIL	Unlocked	32.6%	56.2%	66.7%	27.8%	59.0%	72.3%
	Locked Image	34.5%	56.8%	66.1%	27.2%	57.9%	70.2%
	Locked Text	30.6%	54.4%	64.6%	27.8%	59.0%	71.6%
	Locked*	30.1%	52.4%	63.1%	25.0%	55.7%	69.1%
	CLIP-LoRA $r=4$	33.8%	57.3%	67.6%	28.9%	61.4%	74.1%
	CLIP-LoRA $r=32$	35.6%	58.3%	68.1%	30.7%	62.6%	74.6%
	CLIP-LoRA $r=256$	35.5%	57.7%	67.8%	30.8%	62.4%	74.4%

Rank r - size of residual adapters weight matrices.

Summary - FETA

- Automatic pipeline for extracting data from documents.



Summary - FETA

- Automatic pipeline for extracting data from documents.
- Expert data for which we found that FMs performance is poor.

The NEVER ENDING job

We have decided to help create a world where we take better care of the environment, the earth's resources and each other. We know that sometimes we are part of the problem. So, we are working hard to become a part of the solution. We are weighing the pros and cons, continually examining and changing things. All these steps, in lots and lots of areas, add up to something big... and noticeable. The job has already started, and it is a never-ending one. Follow our progress at KFA-USA.com/theneverendinglist

#24 IMPROVEMENT - Our new seat base and seat back covers will become car-free by 2015. We'll use 100% recycled PET plastic.

#49 IMPROVEMENT - The soft, stretchy woven fabric in the 315A-K1000 has been made from 85% cotton and 15% lycra. Lycra is a renewable natural material derived from wood. More than 90% of the lycra used in the 315A-K1000 is recycled by a state-of-the-art process that produces no waste.

#29 IMPROVEMENT - For every reusable lamp sold, KFA Social Initiative donates \$100 to the Red Cross. The 315A-K1000 lamps have been sold. SUNNAN single-use solar cells that transform sunlight into electrical energy and require no electrical connections. Last change the solar for 3-12 hours to direct sunlight. K1000s will get three hours of use. K1000s you can use anywhere outdoors.

\$1999
SUNNAN work lamp \$19.99
Plastic, steel and aluminum
Designer: Nicolas Costantini
KFA 1177. Assembled colors
\$81,543.75



#16 IMPROVEMENT - The pillow covers are made from a strong yet lightweight material using a very efficient production technique. Like RECI, it has a 100% recycled paper lining, which is a more efficient use of the materials and makes it easier to transport.

#68 IMPROVEMENT - The manufacturing of printed covers can consume large amounts of water and dye. Today, 95% of KFA's printed textile products, including MATHIS III LEVEL, are produced with techniques that require less water and dyes. The result being better quality prints as the fabric is softer than a regular color print. In addition, our fabrics are more durable, making it particularly useful for children's bedding, which requires more washing.



#15 IMPROVEMENT - The RECI desk is made of 100% recycled, 100% recycled paper — a fabrication of paper for its strength and rigidity. RECI desks last the longest than particle board. It is also more lightweight and thus easier to handle during transportation and for use at home.



\$599
KFA 315A-K1000 C1000
KFA 315A-K1000 C1000
renewable cover. Imported. KFA
315A-K1000 C1000
KFA 315A-K1000 C1000

#13 IMPROVEMENT - It has been a challenge to transport and store our heavy DTDIF sofas in a cost-effective and environmentally sound manner. So we recently made DTDIF a customer assembly item, and now it's packed in a way that reduces space needed for transport and warehousing by half. Each DTDIF sofa now fits twice as many sofas, which has made transport costs more efficient. So we can offer the price along with improved sustainability and standard quality.

Controls Opening and closing

The warning lamp in the instrument cluster lights up while the engine is running: the remote control is no longer inside the vehicle. After the engine is switched off, the engine can only be restarted within approx. 10 seconds.

The indicator lamp in the instrument cluster lights up and a message appears on the Control Display: **replace the battery in the remote control.**



Replacing the battery
The remote control for Comfort Access contains a battery that will need to be replaced from time to time.

1. Take the integrated key out of the remote control, refer to page 30.



2. Remove the cover.
3. Insert the new battery with the plus side facing up.
4. Press the cover on to close.

Dispose of the old battery at a collection point or at your BMW center. ◀

Windows

To prevent injuries, watch the windows while closing them. Take the remote control with you when you leave the car; otherwise, children could operate the electric windows and possibly injure themselves. ◀

Coupe: opening, closing

▶ Press the switch to the resistance point: The window opens as long as you press the switch.

▶ Press the switch beyond the resistance point: The window opens automatically. Press the switch again to stop the opening movement.

You can close the windows in the same manner by pulling the switch.



Convertible: opening, closing

Individually

▶ Press the switch to the resistance point: The window opens as long as you press the switch.


▶ Press the switch beyond the resistance point: The window opens automatically. Press the switch again to stop the opening movement.

You can close the windows in the same manner by pulling the switch. The rear windows do not close automatically.

Summary - FETA

- Automatic pipeline for extracting data from documents.
- Expert data for which we found that FMs performance is poor.
- FETA's MIL-CLIP learn from documents' pages.

Positive texts bag

2. Remove the cover.
 3. Insert the new battery with the plus side facing up.
 4. Press the cover on to close.
-  Dispose of the old battery at a collection point or at your BMW center. ◀

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Individually

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0.15

0.3

0.55


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Future Work

- Our code is available on Github.
- Automatically create new datasets in Medical, Patents, etc.
- Test FMs on your own data of choice.
- Create new method to adapt FMs on expert data.



Thank you for
listening!

Come to our poster
and let's talk!

