DATA AUGMENTATION

Artificial Intelligence

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KCE074BCT004

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Definition

Data Augmentation is the strategy that enables practitioners to significantly increase the diversity of the data available for training models, without actually collecting new data.

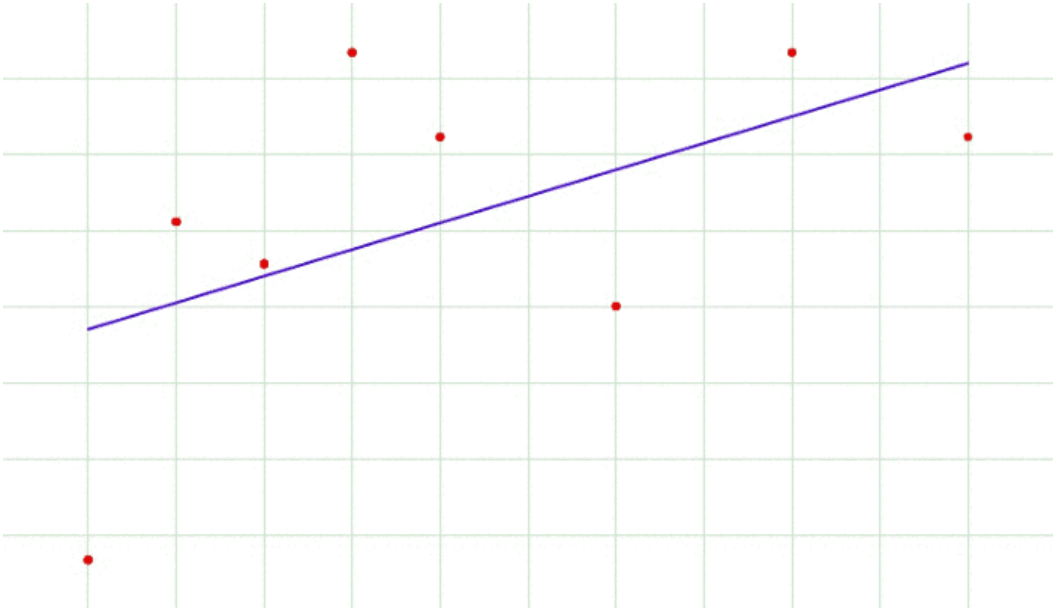
Why do we need Data Augmentation?

- The more the data, the better the model performs.
- It helps in reducing overfitting.

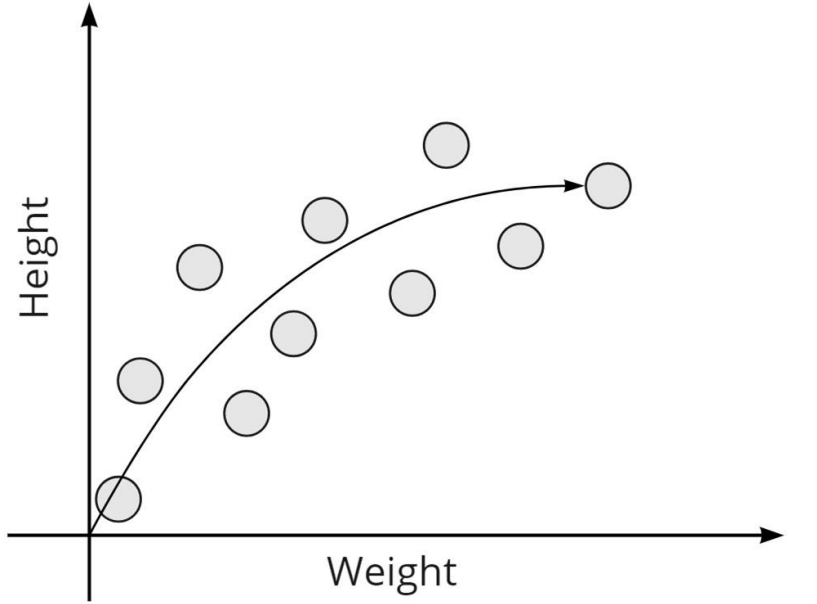
Andrew Ng, “scale drives machine learning progress”

Quantity matters, but so does the quality

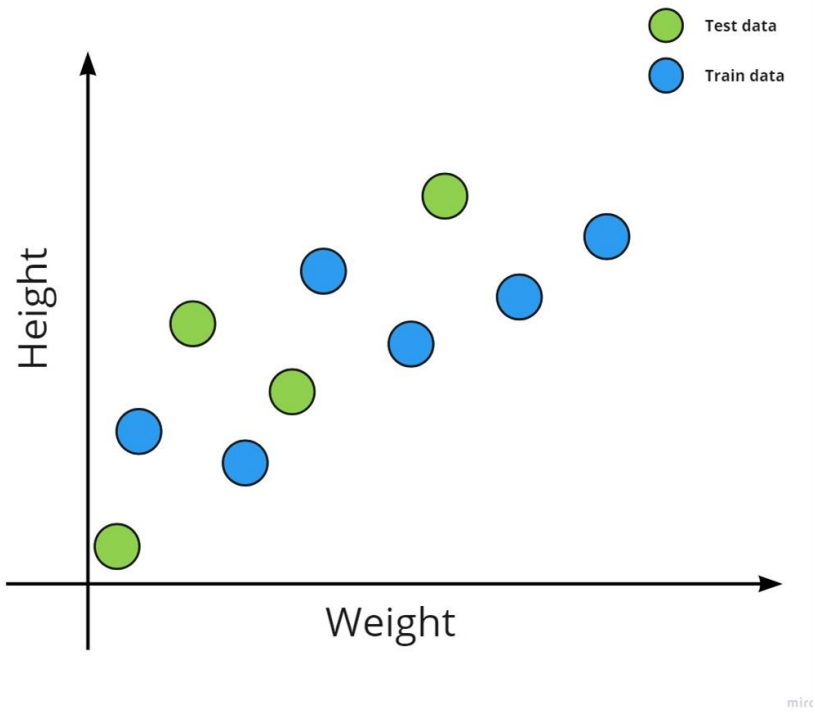
Overfitting



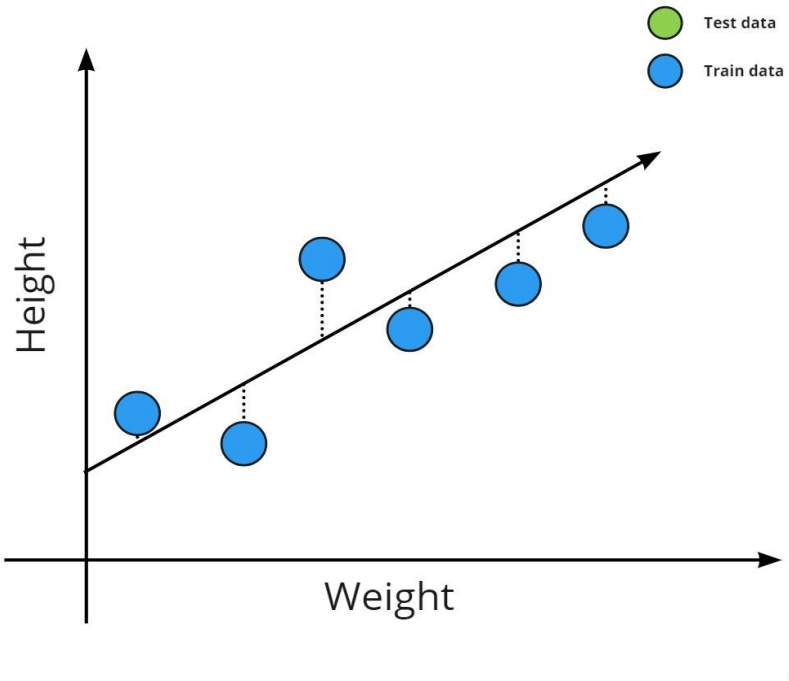
Total Data



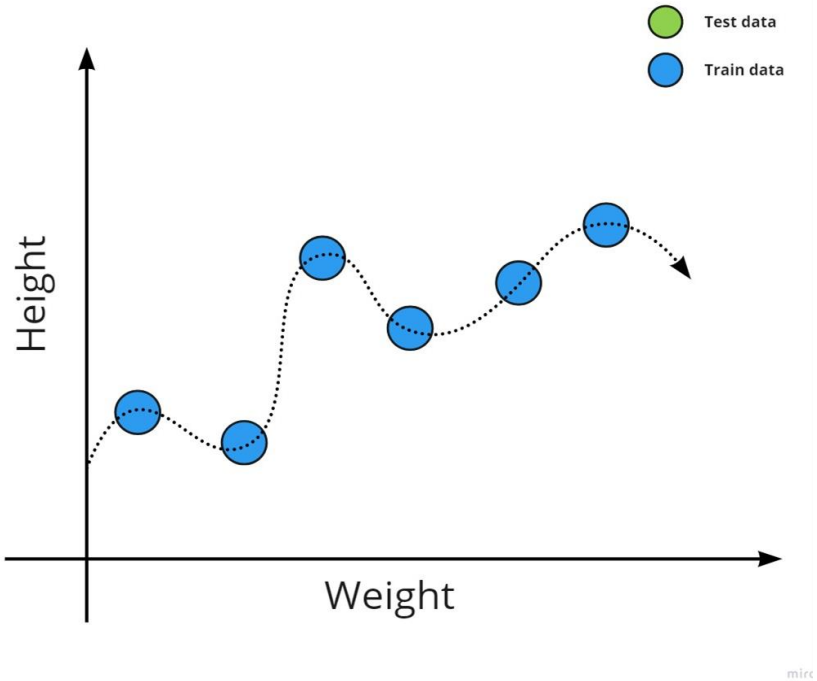
Splitting into train and test



Fitting the training data

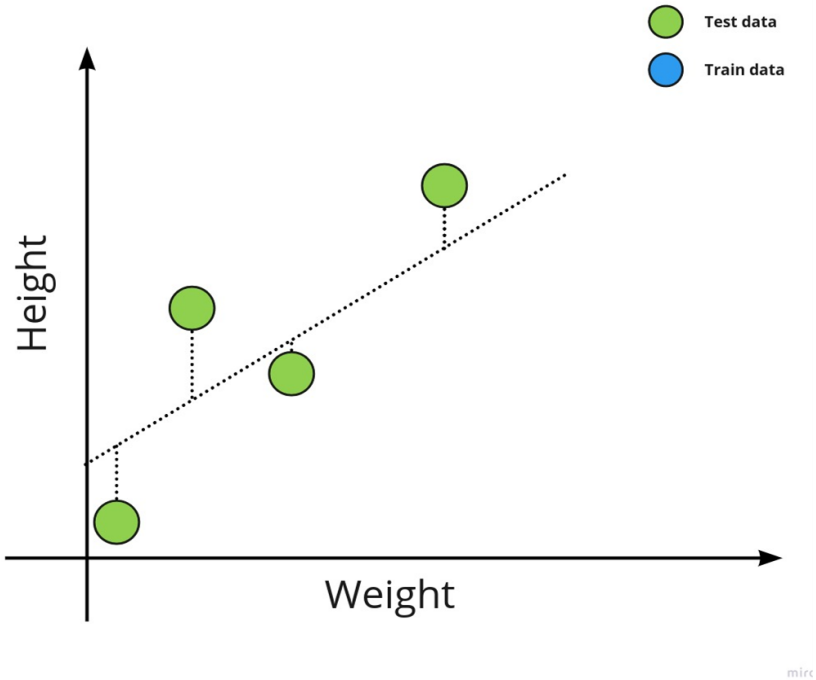


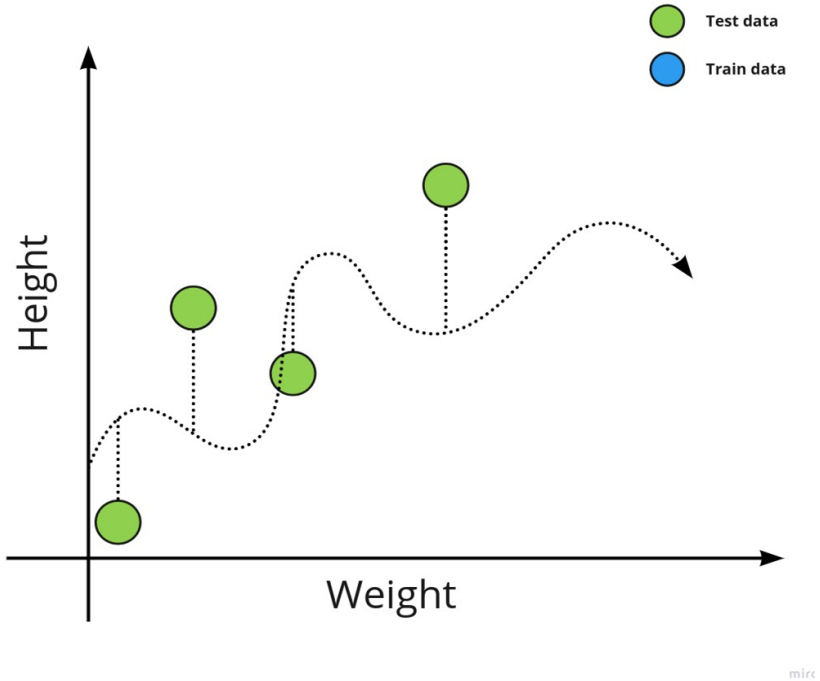
Underfitting (high bias)



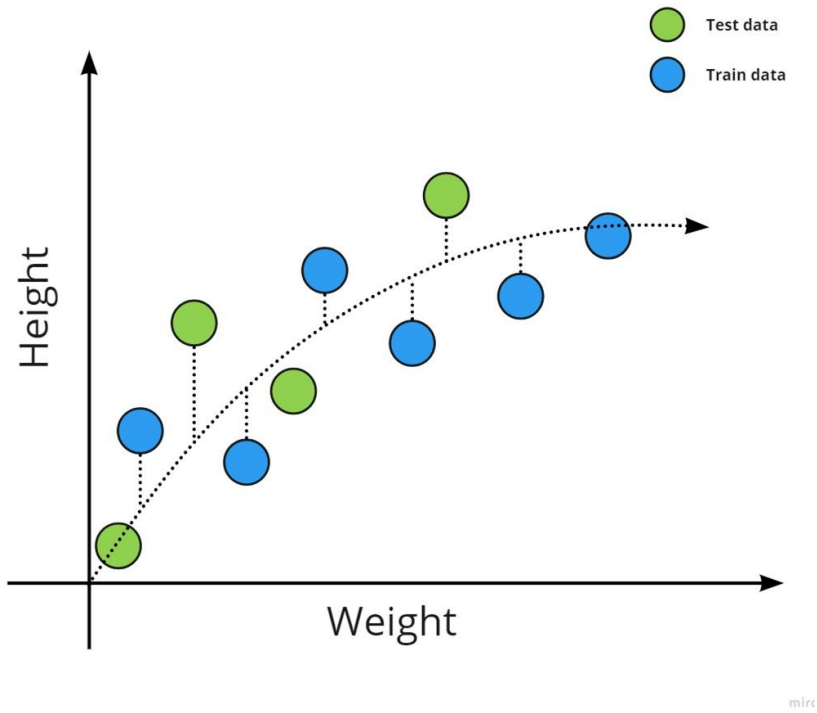
Overfitting (high variance)

Prediction of testing data





Optimal Solution



Low bias and Low variance

Where can it be used ?

- Images
- Texts
- Videos
- Audios

Image Augmentation

Image Augmentation is the technique that can be used to artificially expand the quantity and diversity of the training images artificially by creating the modified versions

Image Augmentation

Horizontal and vertical flipping

Horizontal flip

(Horizontal + Random) flip

Cut out and Distort Color

Cut out

Distort color

Distorted bbox crop and Random pad crop

Distorted bbox crop

Random pad crop

Zoom and Rotation

Zoom

Rotation

Lighting and Rotation-Zooming

Lighting

Rotation-zooming

Full Combinations

Forgot the overfitting?
Where is overfitting in all this?





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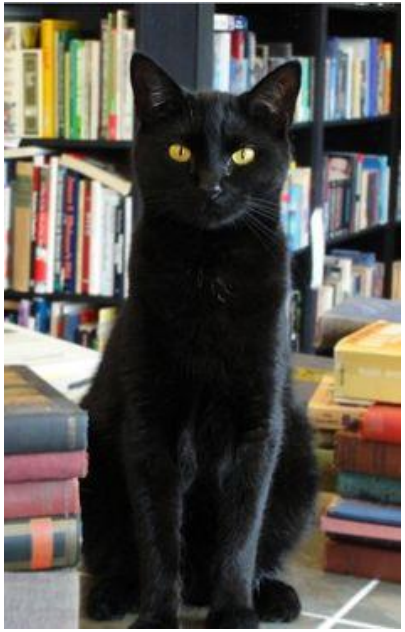


What are these?

Data Augmentation to rescue

Text Augmentation

Text Augmentation is the technique that can be used to artificially expand the quantity and diversity of the words and sentences artificially.

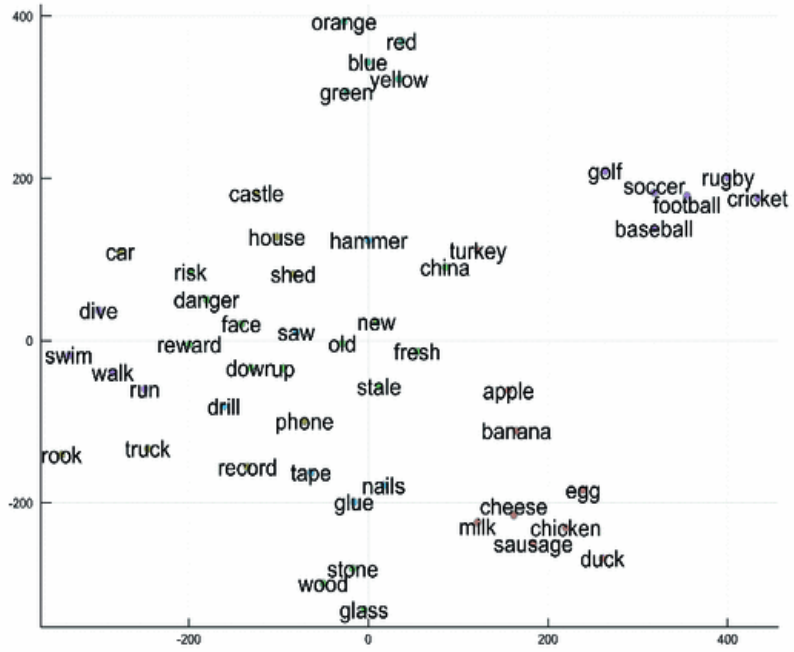
Simulating keyword distancing error

Character	Possible Replacement
e	2, @, 3, #, 4, $, w, r, s, d, f
f	r, e, t, g, v, c, d, x
k	u, i, o, j, l ,, >, ., <

The quick brown fox jumps over the lazy dog

The wuick vrown gox jymps pver tne ;azy dof

Word Embeddings

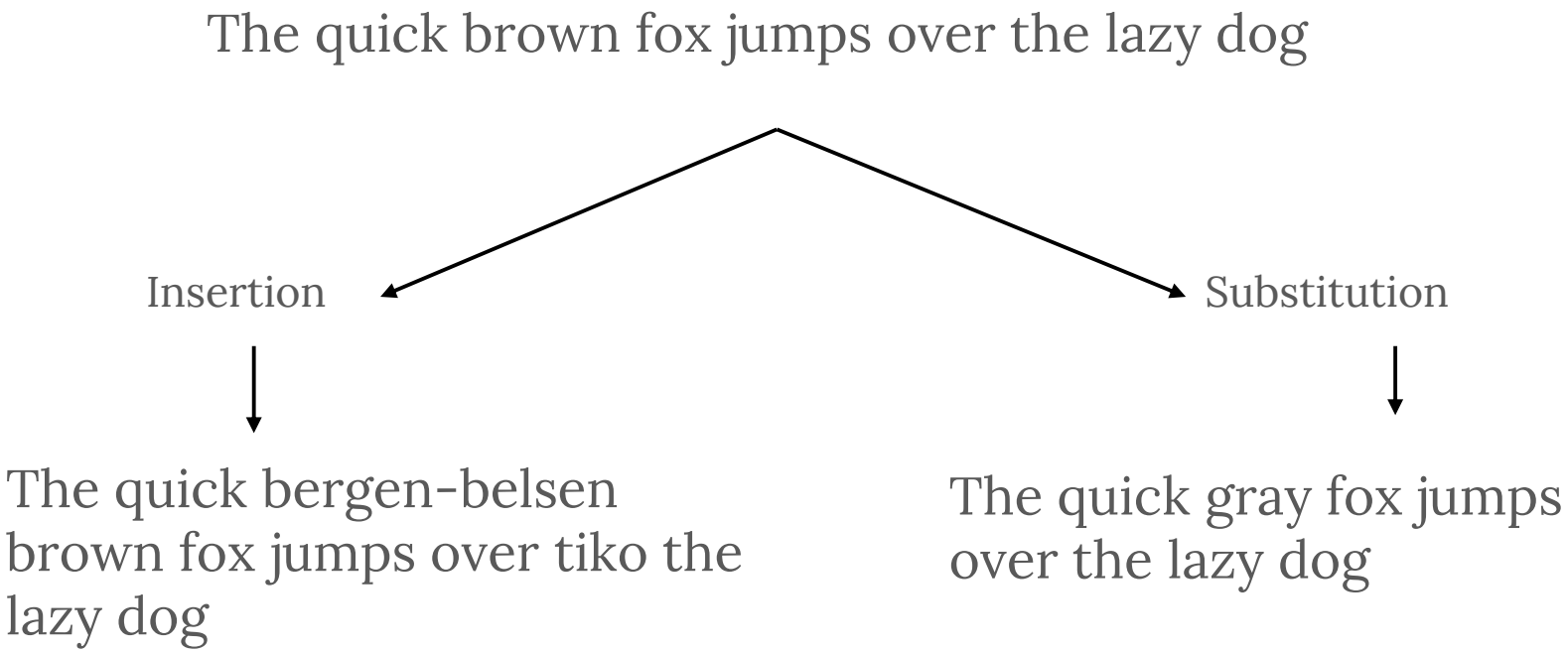


Word Embeddings of Fox

word2vec	GloVe	fasttext
foxes	nbc	henhouse
squirrel	abc	foxes
rabbit	cbs	hare
squirrels	turner	Fox
coyote	disney	fennec

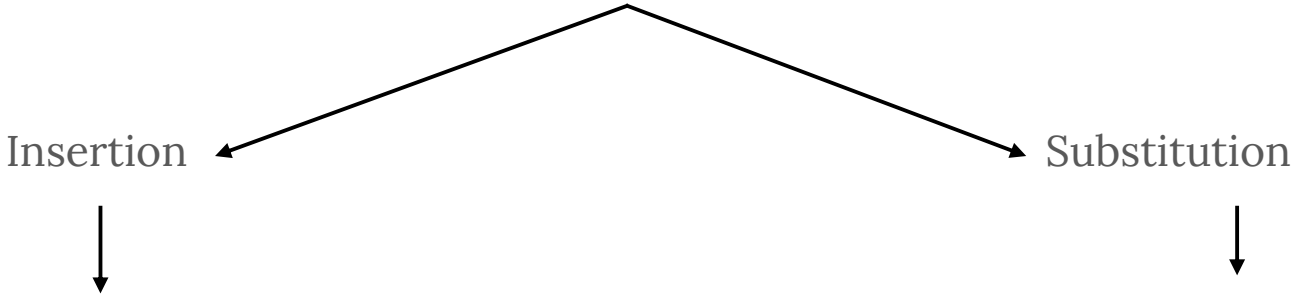
Most similar words of 'fox' among classical embeddings models

Word Embeddings



Contextual Word Embeddings

The quick brown fox jumps over the lazy dog



The lazy quick brown fox always jumps over the lazy dog

The quick thinking fox jumps over the lazy dog

The quick brown fox jumps over the lazy dog

Synonym

The quick brown fox parachute over the lazy blackguard

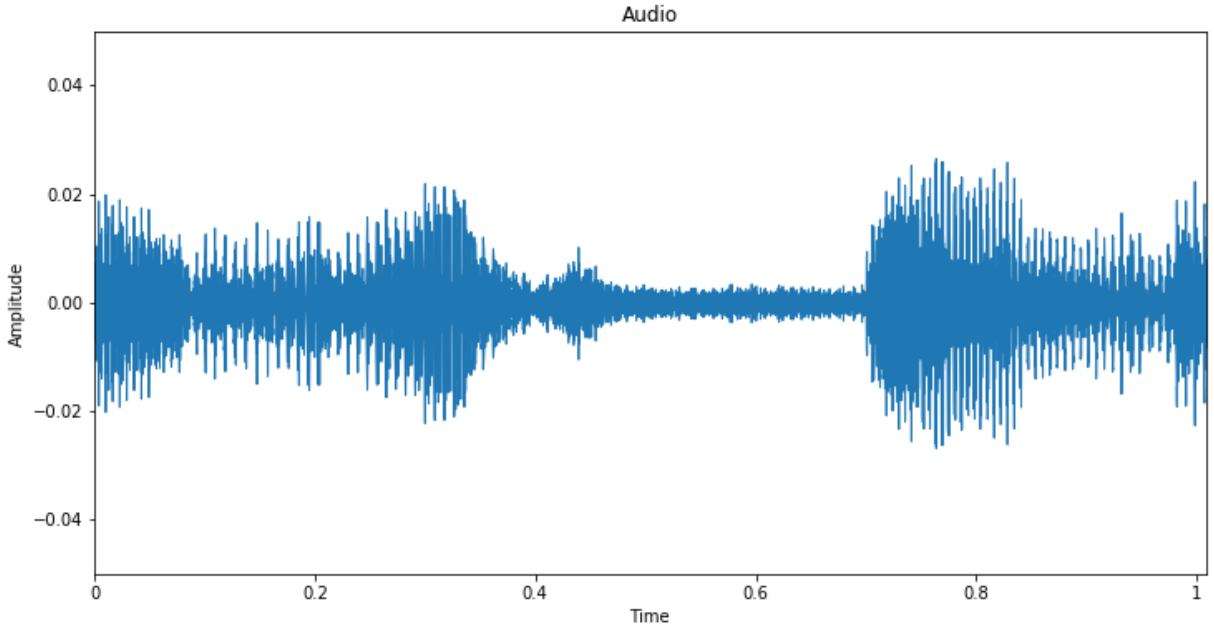
Word deletion

The quick brown fox jumps over lazy dog

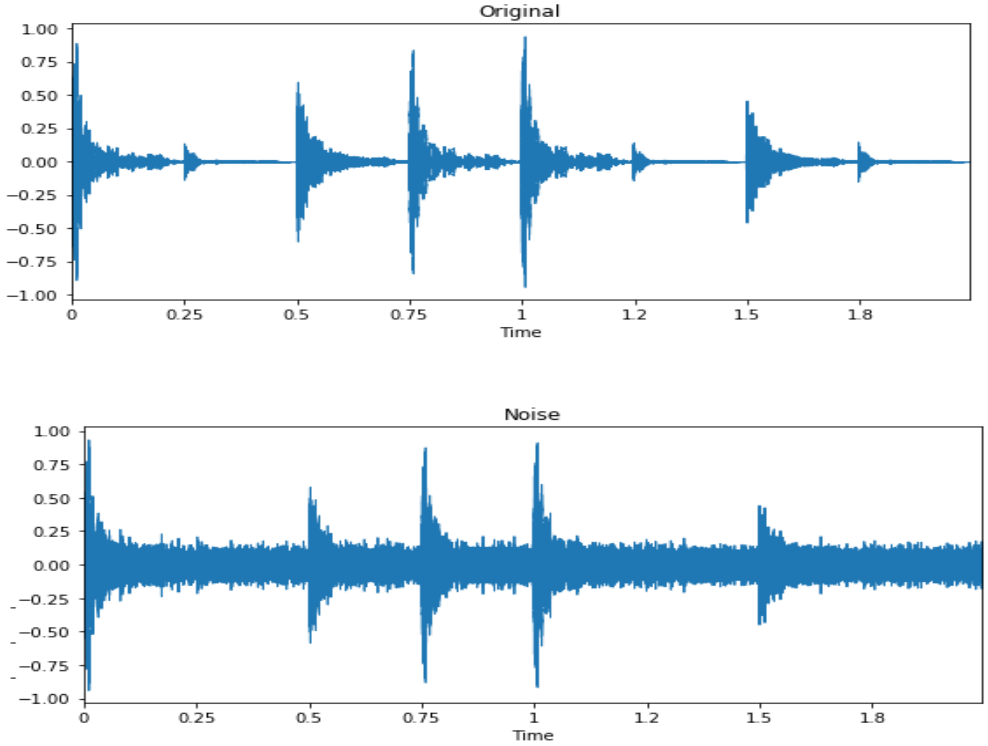
Random character

T(he qouickd bwrown flox jumpvs overz kthe csazy dod

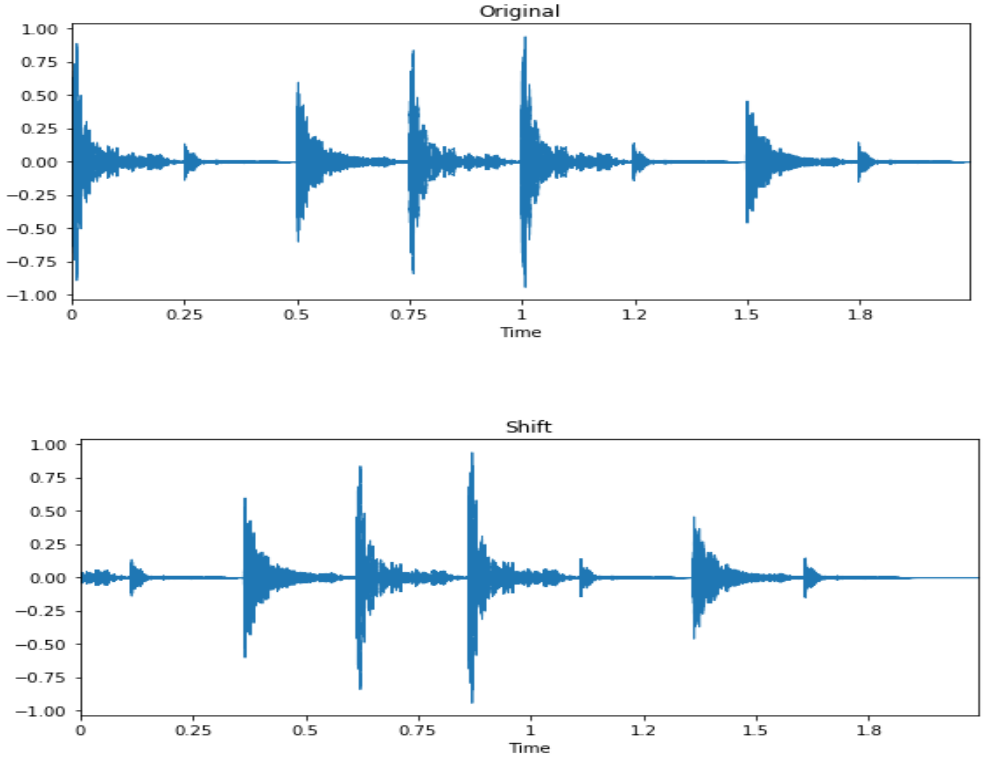
Audio Augmentation



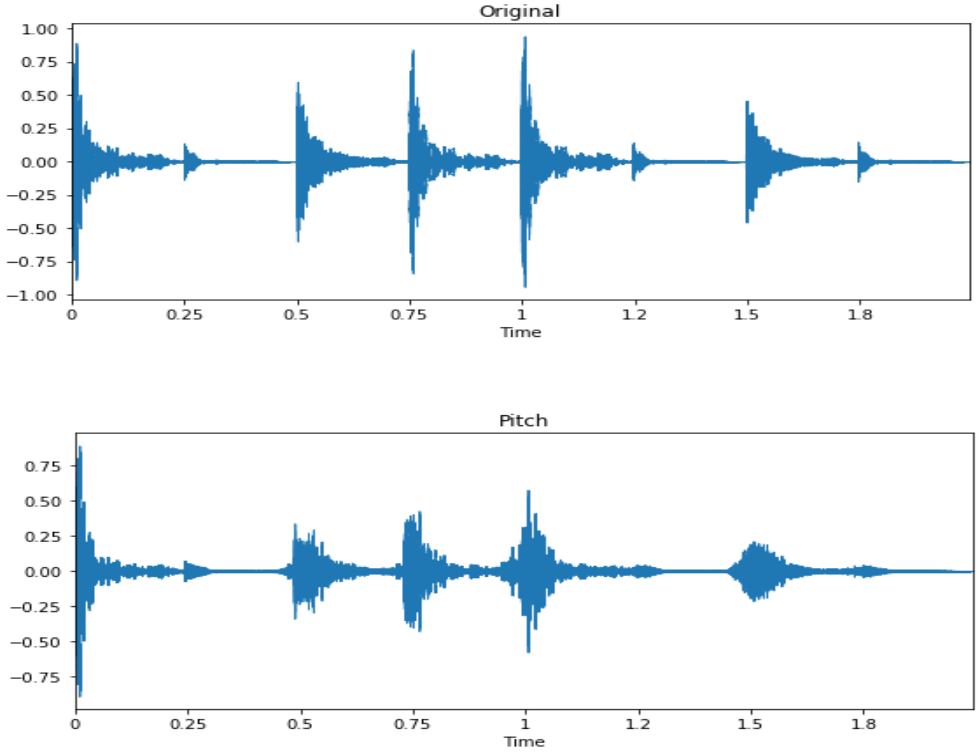
Noise Injection



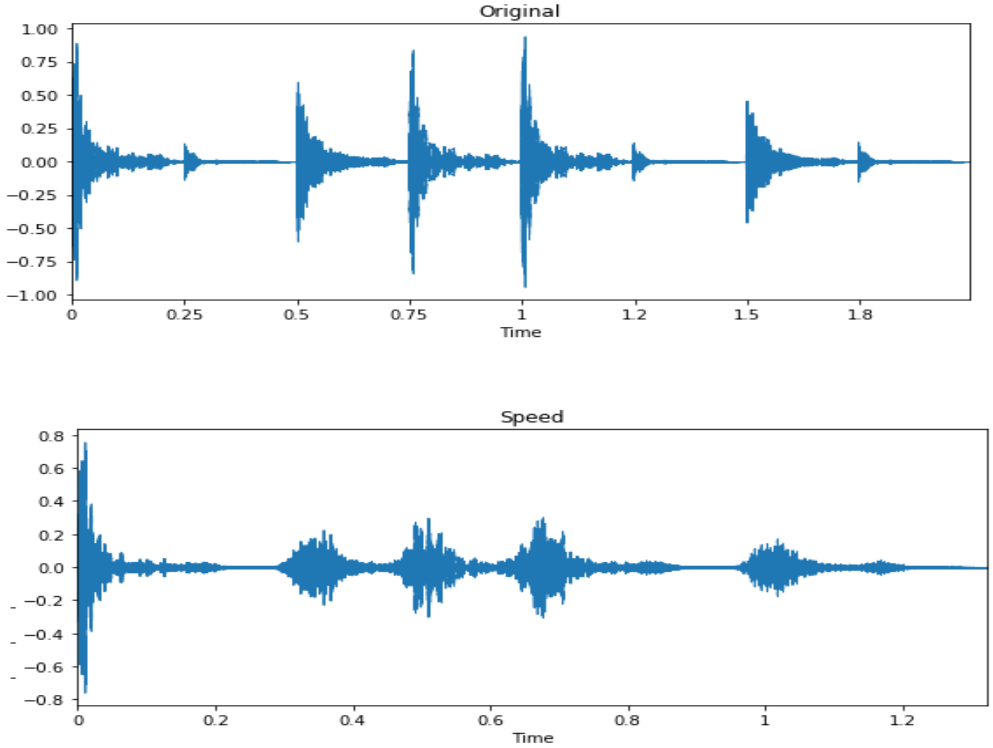
Shifting Time



Changing Pitch



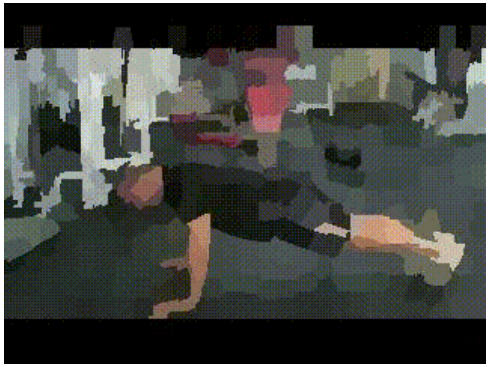
Time stretching



Video Augmentation

Original video

Piecewise Affine Transform

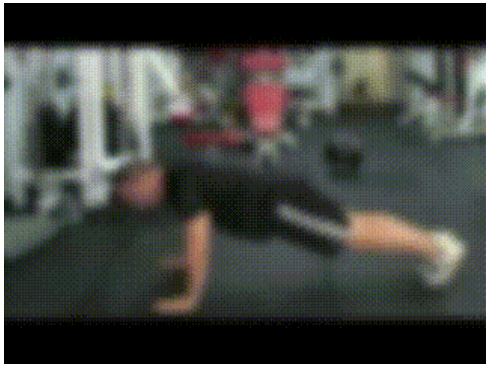


Superpixel

Invert Color

Random rotation

Random resize

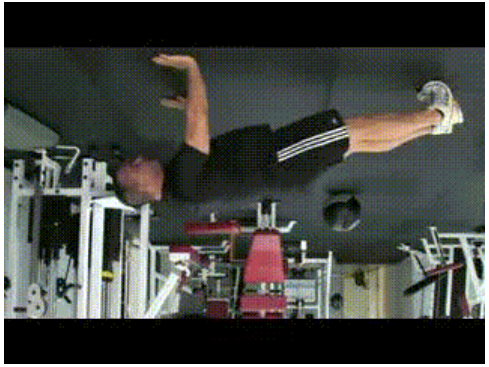


Gaussian Blur

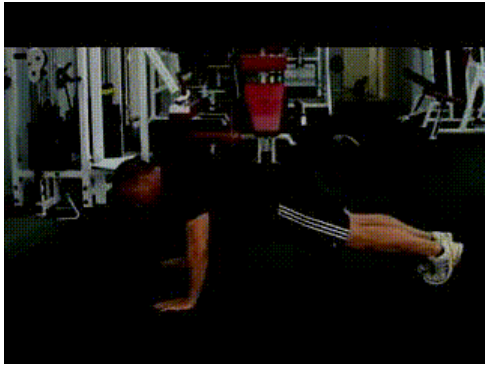
Translation

Random crop

Horizontal flip



vertical flip

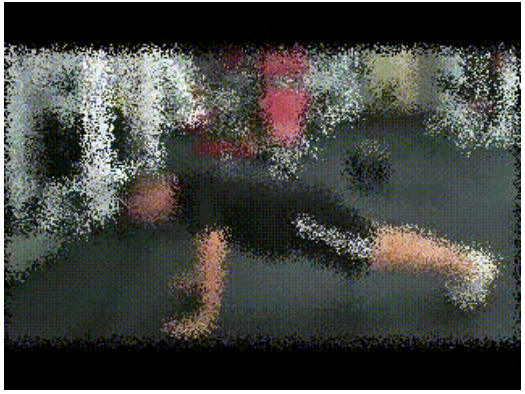


Addition

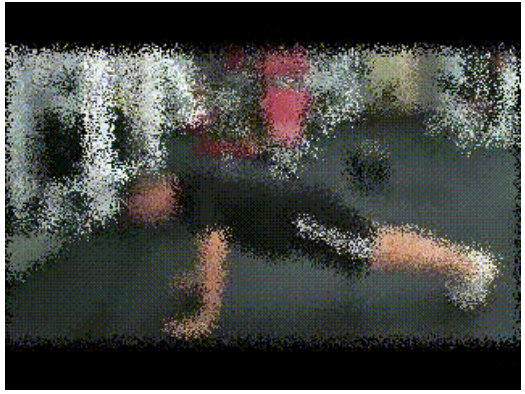
Multiply

Down sample

Up sample



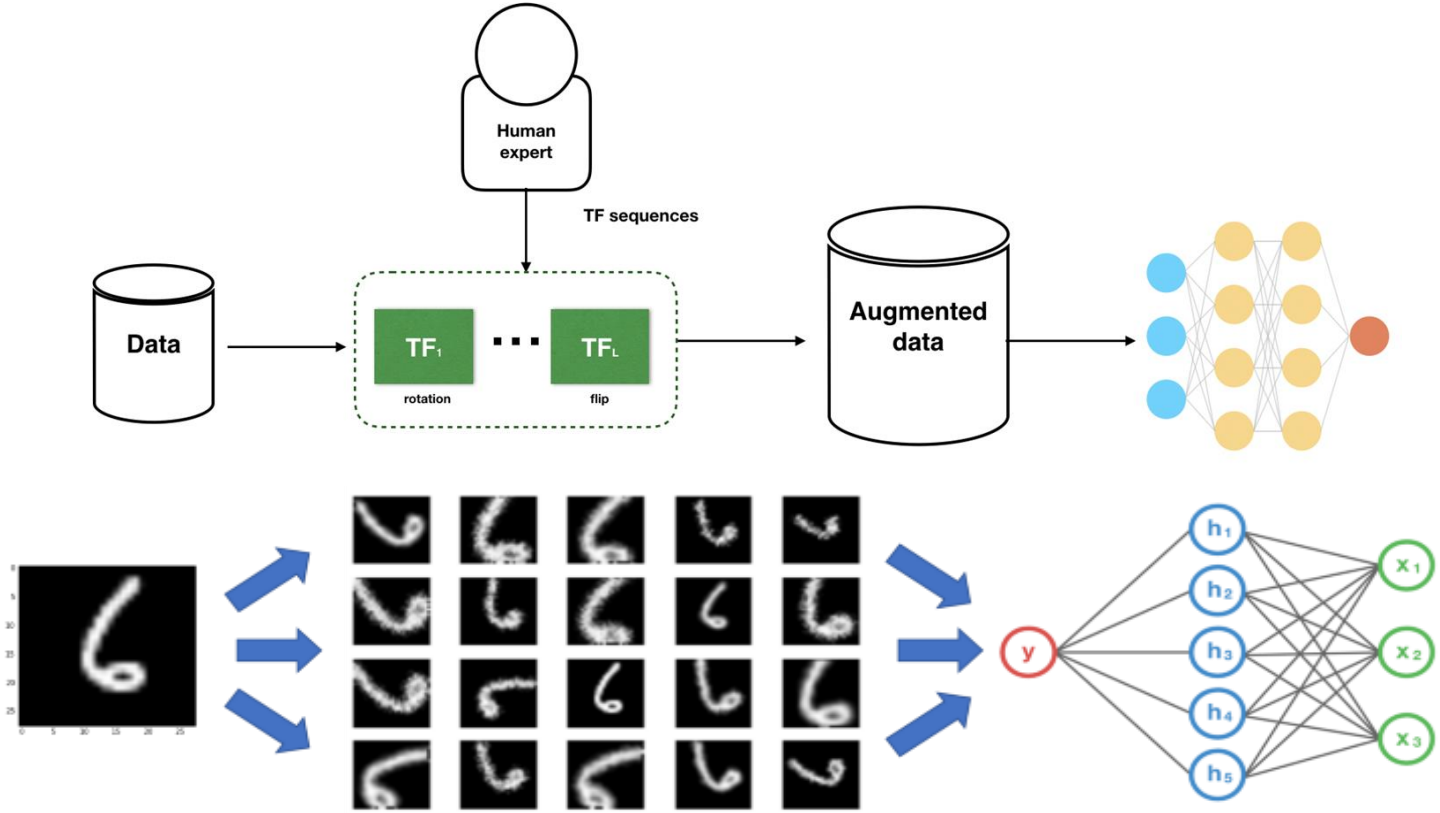
Elastic transformation

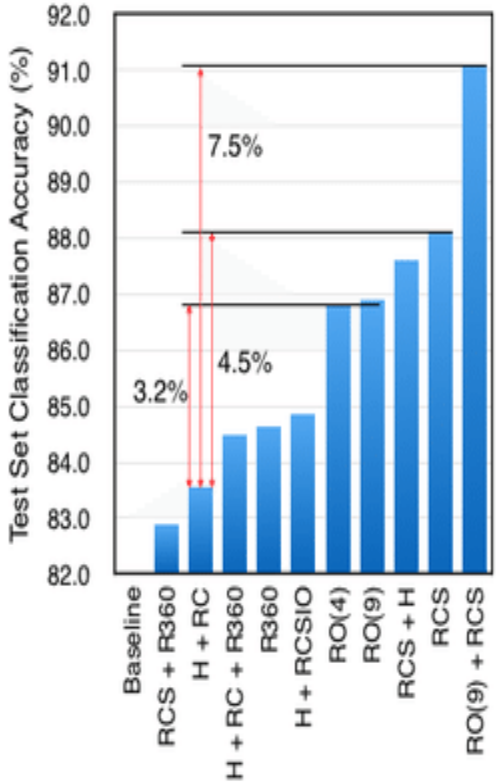


Salt

shear

Don’t have enough storage?





Data Augmentation Type	Description Augmentation = Randomly Applied:	Final Training Set Loss	Test Set Classification Accy (%)	Test Set Classification Error(%)
Baseline	No Data Augmentation	0.4	82.0	18.0
RCS + R360	Random Crop Size + Rotations	0.41	82.9	17.1
H + RC	Mirroring + Fixed Size Crop	0.4	83.6	16.4
H + RC + R360	Mirroring + Fixed Size Crop + Rotations	0.4	84.5	15.5
R360	Rotations	0.4	84.6	15.4
H + RCSIO	Mirroring + Random Crop Size with Zoom In and Out	0.39	84.8	15.2
RO(4)	4 Vertex Polygonal Occlusions	0.36	86.8	13.2
RO(9)	9 Vertex Polygonal Occlusions	0.36	86.9	13.1
RCS + H	Random Crop Size + Mirroring	0.41	87.6	12.4
RCS	Random Crop Size	0.36	88.1	11.9
RO(9) + RCS	9 Vertex Polygonal Occlusions + Random Crop Size	0.38	91.1	8.9

References

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