A Motion Picture Content Rating Model for Supporting Automatic Classification using Deep Neural Network

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Introduction

The film industry brings thousands of films to life every year. Not all of them are suitable for all ages, especially those with violent scenes. Since **content rating** can be tedious and prone to personal judgment, it is necessary to identify **objectively inappropriate elements** within videos.

Non-violent frame
(G class)

Violent frame
(PG-13 class)

Very violent frame
(R class)

Goal

Provide a motion picture content rating model to **automatically classify and censor violent scenes** using a Deep Learning approach.

Our Idea

We developed two models based on Inception v3 architecture (three-class and binary classifier). Some modifications were made to improve both **deep neural networks** performances, avoid overfitting, and increase the generalization level.

Dataset and Training

We collected a **large amount of data** searching for visual elements, such as blood, weapons, or fire, and **manually labeled** them according to a rating scale. The training was performed using MATLAB and Nvidia GeForce GTX 1080 Ti GPU (three-class classifier: 23h; binary classifier: 4h).

Train/Val Dataset	Test Dataset
17,000 images per class (random 90% for train and 10% for val)	1,850 images per class
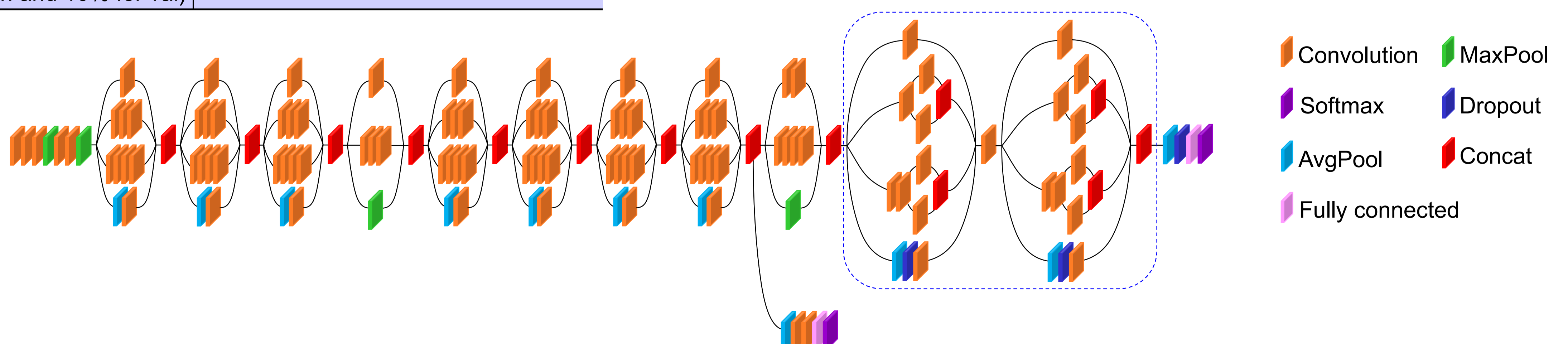
Results of the 1st test phase

Three-class classifier

Output Class		G	PG-13	R	
	G	**1221** 22.0%	**149** 2.7%	**66** 1.2%	85.0% 15.0%
	PG-13	**444** 8.0%	**1544** 27.8%	**323** 5.8%	66.8% 33.2%
	R	**185** 3.3%	**157** 2.8%	**1461** 26.3%	81.0% 19.0%
		66.0% 34.0%	83.5% 16.5%	79.0% 21.0%	76.1% 23.9%
		G	PG-13	R	

Target Class

Binary classifier

Output Class		G	R	
	G	**1632** 44.1%	**118** 3.2%	93.3% 6.7%
	R	**218** 5.9%	**1732** 46.8%	88.8% 11.2%
		88.2% 11.8%	93.6% 6.4%	90.9% 9.1%
		G	R	

Target Class

Refinement Algorithm

We designed an algorithm to refine the network output in the 2nd test phase (video as input data).

Network classification

1	2	3	...	19	20	21	22	23	24	25	26	27
G	R	G	...	G	R	R	R	R	R	R	G	G
0.99	0.90	0.80	...	0.72	0.91	0.95	0.99	0.99	0.96	0.98	0.80	0.82

threshold = 0.9

vectFramesR

2	20	21	22	23	24	25
R	R	R	R	R	R	R

numConsecutive = 5
ε = 2

Final Output

18	19	20	21	22	23	24	25	26	27
R	R	R	R	R	R	R	R	R	R

Conclusions

We proposed a model for supporting content rating. The interesting preliminary results obtained encourage further investigations on the use of Deep Learning.

Video demo available!

Legend:
Convolution — MaxPool — Softmax — Dropout — AvgPool — Concat — Fully connected