Senior Project - Computer Science - 2014 Facial Tic Detection Using NINON COLLEGE COLLEGE Christopher Leveille Advisor - Prof. Aaron Cass

Abstract

Detecting dishonesty or deception in the features of the face has many useful applications. One such application is in the game of poker, where deceiving one's opponents is a big part of the game. Naturally, an opponent's face can provide a player with information on whether that player is being "truthful" in their betting or not. In this project, we built a system that employs computer vision techniques to automatically detect one common facial tic: a mouth twitch. The system was evaluated based on its ability to accurately detect and identify occurrences of the tic within a video file in real time. It was found to be accurate under ideal conditions, but struggled to correctly detect the tell in a more realistic, less-than-ideal setting.

Data Analysis

Hand #	Time	My Cards	Opponent's Cards	Flop	Turn	River	Notes
1	0:09:22	A J	4 Q	Ah 7c 10c	-	-	Value bet on flop, open mouth
2	0:11:02	Qs 4c	As 4s	Js 5d Kd	8c	2d	Mouth twitch on turn
3	0:13:00	As Jd	6h 7d	2c Kh Ad	-	-	Value bet fail
4	0:14:20	??	??	Qh 7d 3h	Qd	10c	
5	0:16:30	6d 3d	Кс 3с	7h As 3s	4c	8d	Closed mouth, puffed cheeks on flop bet
6	0:18:52	Jc 6c	6h 5s	4d 8c 4c	Qd	7d	Failed bluff raise on flop, eye rub, open mouth, mouth twitch
7	0:20:24	??	??	Kh 5h 8s	As	Kd	
8	0:22:08	7s 8h	2d 3s	5d 2d Jh	7c	3h	Squinting on river bet
9	0:23:58	Kc 4c	Ad 5h	Ks 9h Kh	As	Qs	Value betting, mouth pursed on flop raise, squinting and blinking on turn
10	0:27:01	9d 6h	Kd 9s	4s Ks 6c	3с	4c	



The recorded lab trials were analyzed for tells and each hand was annotated, as demonstrated above. We took note of the players' hole cards and community cards to be able to tell whether the subject player was bluffing or betting for value in a given situation. Based on our analysis of the footage and research into effective computer vision techniques, we decided to pursue building a system to detect twitching of the mouth. This is a facial tic that the subject player exhibited multiple times during the recorded lab sessions when bluffing.

System & Evaluation

🔳 D:\Chris\Documents\Visual Studio 2010\Projects\openCV_FaceTracking\Debug\openCV_FaceTrack... 😐 😐 🕺 🚺 💷 outputCapture

The first decision to make in the project was which tic to design the system to look for. While we could have decided this up front and then tested the system simply by intentionally exhibiting the tell in a video, we decided it would be better to record an amateur player in a live game of poker and see which tells they naturally exhibited. Although the experiment was not completely genuine (since the player was aware he was being recorded), it was more candid for testing purposes than intentionally exhibiting tells in a recording.

Over the course of fall term, we conducted and recorded four lab trials of an amateur player playing heads-up, no-limit Texas Hold'em poker with an offcamera opponent. This footage would be used to decide which tell to look for, and later, to evaluate the system's ability to detect that tell.





The system was developed in Microsoft Visual C++ 2010 using libraries from OpenCV 2.4.8. It uses Haar cascade classifiers to search the image for face- and mouth-like objects, outlining the best matches with colored rectangles on the output image. It can read from either a video file or a webcam stream. When the system detects a face but no mouth in the current frame, it assumes that the mouth must be out of its normal position and displays a "mouth twitch detected" message with a timestamp.

The system works well in detecting mouth twitches under controlled conditions. The face must be upright, facing toward, and clearly visible to the camera with ample lighting in order for the system to work effectively. However, it did not work as effectively on the lab trial videos. We speculate that this is because the subject's attention was mostly invested in the game and not on keeping his head upright and facing the camera at all times, which seems to be necessary for the system's ability to consistently track the face. Also, the mouth twitches exhibited by the subject in the lab sessions were very subtle, making it difficult for the system to recognize them given the distance at which the subject was filmed from.

A: The round, plastic lab table used to play on
B: A strip of blue tape to mark dealing area for dealer
C: The chair where the subject player sits

D: The chair where the opponent player/dealer sitsE: The webcam aimed at the subject playerF: The webcam aimed at the community cards

Prospects for future work include comparing the system to other approaches of detecting a mouth twitch, such as training a Haar classifier to detect mouths that are in a twitching position. Also, extending the system to support detection of other physical mannerisms would make for an interesting future project.