**DATA606**: CAPSTONE

**Team Members**: Hinal Desai, Shreya Salgia, and Levan Sulimanov

**Topic**: Deception Detection

**Phase 0:**

* Student Introduction [Done]
* Team Formation [Done]
* Project Topic: Deception Detection [Done]
* Dataset - **reach out to authors for additional data** [Levan] - due **02/23/2023 - ABORTED**
  + **Total\_Features\_Per\_Video = 468\*30FPS\*3 = 42,120**
  + **Total\_Features\_Per\_Video \* 120 Videos ~= 5,054,400**
  + [**DARE**](https://doubaibai.github.io/DARE/) **- CHOSEN**
  + [**Bag Of Lies**](http://iab-rubric.org/index.php/bag-of-lies)

**Phase 1 - due 02/28/2023 [DONE]**

* Meet to go over slides at 9:30 on 02/27/2023 - [**Shreya, Hinal, and Levan**]
* Confirm what docs and reports needs to be submitted for Feb 28th, 2023 [Levan] - due **02/18/2023**
* Literature Review:
  + Similar Projects List [Hinal] - due **morning of 02/25/2023 - COMPLETED**
    - Summary of Literature Review work. Compose a word document with a list of projects including their brief description. Information is derived on documents that each of us send you from our Literature Review analysis.
  + Research Paper List [Shreya] - due **morning of 02/25/2023 - COMPLETED**
    - Compose word document APA7 format with a list of references to projects and papers that we send you from our Literature Review analysis.
  + Literature Review (4 papers) [Hinal] - due **02/22/2023 - COMPLETED**
    - Summarize paper: (1) Input kinds, (2) models used, (3) dataset, (4) conclusion, and other insights.
  + Literature Review (4 papers) [Shreya] - due **02/22/2023 - COMPLETED**
    - Summarize paper: (1) Input kinds, (2) models used, (3) dataset, (4) conclusion, and other insights.
  + Literature Review (4 papers) [Levan] - due **02/22/2023 - COMPLETED**
    - Summarize paper: (1) Input kinds, (2) models used, (3) dataset, (4) conclusion, and other insights.
* Slides Preparation:

*Note: Hinal is off from [02/24/23 and back on Monday 02/27/2023).*

* + Project **Introduction** & **Slides Template** (What is about, why is this project chosen, what is the question / research / hypothesis?) [Levan] - due **02/26/2023 - COMPLETED**
  + An overview of similar approaches (What is the state of the art? What is missing?) [Hinal] - due **02/23/2023 - COMPLETED**
    - **Input**
    - **Models**
    - **AUC / Accuracy per Video alone, Audio alone, Video+Audio.**
  + An introduction to the dataset (what kind of data will be studied? How large is it? What is the source of the dataset?) [Shreya & Levan] - due **02/26/2023 - COMPLETED**
    - *Also include: graphs for class distribution* [Shreya]*. -* **COMPLETED**
      * *Regenerate graph for video&audio distribution between Truth and Lie*
      * *EDA on quantity of classes - histograms*
      * *EDA of histogram pairs (automated function for producing following plots):*
        + *for Laugh (Truth vs Lie count per each)*
        + *for Smile (Truth vs Lie count per each)*
        + *for Scowl (Truth vs Lie count per each)*
        + *for Frown (Truth vs Lie count per each)*
        + *for Raise (Truth vs Lie count per each)*
        + *for gazeUp (Truth vs Lie count per each)*
        + *for gazeSide (Truth vs Lie count per each)*
    - Prepare the video input function [Levan] - **COMPLETED**
      * Split audio from videos for example purposes
      * Get the total of lengths per video
      * MediaPipe input and visualization

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Upload the ppt/pptx slides for 2/28 here.

The deadline to upload here: 12pm/noon ET on the day of presentation, 2/28.

Name the file as this:

**DS606\_TeamX\_Lastname1\_Lastname2\_Lastname3\_ProjectShortName\_Intro.ppt or .pptx**

(example: DS606\_TeamA\_Desai\_Salgia\_Sulaimanov\_DeceptionDetection\_Intro.pptx)

Time limits: 10 mins per team, plus Q&A time (of up to another 5 mins) as necessary.

Remember, as per the plan in our syllabus, we will finish the PHASE 1: PROJECT PITCH on the 2/28 class. During the Phase 1, you must have been working on:

* make a brief literature/industry research to determine similar projects to their project,
* learn from those studies’ outcomes and differentiate their project than others,
* plan and document the details of the planned implementation **(Swap Mediapipe with OpenFace)**.
* get familiar with your datasets and carry out transformations and cleansing, if necessary, and (**Not done it - Levan**).
* carry out some basic exploratory data analysis on their data sets (Doing it by 02/26/23).

At the end of this phase, each group will make a presentation to their classmates and the instructor. This presentation should include

* an introduction to the project (What is it about? Why is this project chosen? What is the research question/hypothesis?), - **(make sure to make it clear - Levan).**
* an overview of similar approaches (what is the state of the art? what’s missing?) - **(Make it clear in slides, include information from notes under State of Art slide - Hinal).**
  + **Include also a very brief summary of what have other people have done on the dataset (what kind of feature selection/extraction & classification/regression, analysis etc), and what are your potential proposed methods, and how yours will be different. - Hinal.**
* an introduction to the dataset (what kind of data will be studied? how large is it? what is the source of the dataset?) - **(clean up slides - Shreya)**.
  + Push code to github
    - Levan pushes code to Git
    - Shreya pushes code to Git
    - Hinal submits
      * ppt Phase 0 and 1 to Git and and
      * Phase 1 ppt to Course Page

So, in this Project Pitch presentation, you introduce your project to the audience, to the rest of the class and me. The first slide should have your individual names, your team name, and a detailed title of your project.

You need to have the link to your Team/Group Github page, and a snapshot of the Github page also on one or two slides.

In the next couple of slides, introduce your project and dataset, i.e. describe the dataset and what kind of machine learning (ML) or data analyses (DA) will you do on it (prediction?classification?clustering?)

Provide a link to the dataset, a clear description i.e. clear info on data size, #instances/#samples, #raw attributes, #features you can most likely select/extract/use, will you do a classification or prediction, if it is a classification how many **categories**, i.e. number of categories, what are the categories etc.).

**Include also a very brief summary of what have other people have done on the dataset (what kind of feature selection/extraction & classification/regression, analysis etc), and what are your potential proposed methods, and how yours will be different. - Hinal.**

provide the current state of the best score in its leaderboard.

You need to do and present some basic exploratory data analyses (EDA) on the dataset, and the EDA should provide a good insight into your data. Bar plots, pie charts, visualizations are great. **Provide at least the core of the programming code that you wrote to come up with those plots/charts. - share code on GitHub - Shreya and Levan**

List key references on the last slide and cite those references, and/or, list a reference at the bottom of the slide that you cite/mention the reference.

And overall, you need to incorporate my feedback & suggestions from your previous presentation(s).

Please limit your number of slides to a total of **12 slides.** I would like ALL of the team members to be involved in the presentation, **ideally about equal time of talk/presentation for each**. This presentation will be graded. **Please adhere to the max time limit.** Do not finish too early either, since this is your chance to showcase and talk about your project and 10 mins is not too long, fill it in. During your regular presentation time, i.e. before the Q&A, I usually try not to interrupt, but I may interrupt to ask a question for clarification if your presentation is missing some crucial information such as your data size, number of categories, other important info listed above, etc.

During the presentations' Q&A time, you should ask questions to other teams and you are welcome to give them feedback and suggestions as time allows. I will also try to take note of those questions & feedback, and they will count towards your "participation" score at the end of the semester. I will try to allow as much Q&A time as reasonably necessary, but we need to limit with 5 mins Q&A this time.

I will grade your presentation based on how you adhere to the instructions above as well as the clarity of your slides and verbal presentation, demonstration of your understanding of the dataset and what kind of ML/DA need to be done on it and how well you answer any questions.

Check this item daily as I may update it.

[uploaded 2/22/2023 ~noon/12pm ET;

updated 2/22/2023 ~1:15pm ET]

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**Phase 2 - EDA & Model Construction - due 04/04/2023**

PHASE II: EDA & Model Construction

In the second part, groups will

* complete their data exploration stage (the dataset should be completely ready after appropriate cleansing and transformations; all the members are expected to be familiar with all the major patterns and trends in dataset)
* construct their model (i.e. if it is a regression problem, then groups should have their codes ready that are compatible with the dataset; if it is a neural network implementation, then students should complete at least one successful training, etc.) **Also show model evaluation.**
* Again, each group will make a presentation to their classmates and the instructor.
* All the progress needs to be documented on the group GitHub repo.

**Note:** When each of us researches a certain topic, we share it in the group, after which each of us implements it to gain experience in that skill. This will help each of us to both do work in parallel, but also get knowledge equally. For instance, Hinal researched OpenFace and set up an initial demo. She then shares with each of us how she done it - after that our Shreya’s and Levan’s task is to get it running on our own machines. Whereas someone else setup a logic to fuse visual and audio features together - he or she then shares it in the group, and everyone’s task is to get it running on their own machines.

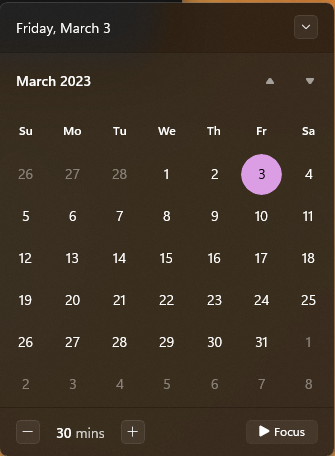
By following this approach, we will be able to confidently navigate throughout our project and later use it in our own portfolio.

Week 1: 02/28/2023 - 03/05/2023 (Team meeting on 03/03/2023):

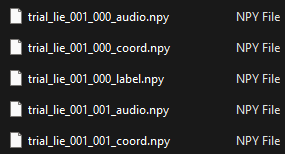
* Add Phase 2 instructions - [**Levan**] - due **03/03/2023 - ONGOING**
* Setup task list for Phase 2 - [**Levan**] - due **03/03/2023 - ONGOING**
* Setup initial demo for OpenFace - [**Hinal**] - due **03/03/2023 - [COMPLETED]**
* Prepare MediaPipe data + Audio + Label files using DARE - [**Levan**] - due **03/05/2023  
  <<<REQUIRES REGENERATION>>>**
  + visual\_feature\_SomeLabel.npy
  + audio\_feature\_SomeLabel.npy
  + fused\_feature\_SomeLabel.npy
  + SomeLabel.npy
* Prepare OpenFace data + Audio + Label files using DARE [**Hinal**] - due **03/05/2023 - [COMPLETED]**
  + Check if OpenFace has a model parameter.
  + visual\_feature\_SomeLabel.npy / csv
  + audio\_feature\_SomeLabel.npy
  + fused\_feature\_SomeLabel.npy
  + SomeLabel.npy
* Generate one video Face Alignment using OpenFace - [**Hinal**] - due **03/18/2023 -**
* Prepare csv list of video with their associated lengths - [**Shreya**] - due **03/04/2023 - [COMPLETED]**:

| Video Path | Video Length (seconds) |
| --- | --- |
| data/../some\_sample\_name\_1.mp4 | 3.2 |
| data/../some\_sample\_name\_2.mp4 | 1.5 |

* Research 3 ways people do video+audio feature fuse (derive at least two approaches from our literature review) - [**Shreya**] - due **03/08/2023 - [COMPLETED]**
  + Early Fusion (V) - concatenation video+audio arrays - Shreya - due **03/13/2023**
  + Late Fusion (~) - Shreya
    - Read about it, start on the code, and list questions for Professor before class - due before class on **03/14/2023**
    - Generate Late Fusion data - due **03/18/2023**
  + Feed audio and video features separately (V) - we have **raw data** for it - **COMPLETED**
  + Attention feature fusion - (~) - assigns weights to features. Assumes arrays have similar shapes.
  + PCA (reducing, but requires **padding**).
* Read through **Early Fusion** + **Late Fusion - [Shreya] -** due **03/18/2023**:
  + <https://www.researchgate.net/publication/354984828_Early_intermediate_and_late_fusion_strategies_for_robust_deep_learning-based_multimodal_action_recognition>
* Implement suggested approaches from above paper - [**Shreya**] - due **03/22/2023**

Week 2: 03/06/2023 - 03/12/2023 (Team meeting on 03/10/2023):  


* EDA on processed data - **[Shreya, Hinal, Levan]** - due **03/10/2023**
  + Visual feature npy length count per label - Hinal - due **03/17/2023**
  + Audio feature npy file count per label - Shreya - due **03/17/2023**
  + Fused feature npy file count per label - Levan - due **03/17/2023**
    - PCA (V)
    - Raw (V)
    - Early Fusion (V)
    - Late Fusion (~)
  + Count of dummy values in each file
    - Tangible - let’s skip this part for now and only do videos that fit the buffer.
  + Additional graphs include:
    - …



* Split data into Train, Test, and Eval - [**Shreya**] - due **03/18/2023**

**FOCUS FOR WEEK 3 (03/17/2023 -> 03/24/2023)**

Shreya is doing [03/22/2023]:

* Fusion research paper reading
* Implement early fusion
* Implement late fusion

Hinal is doing [03/22/2023]:

* Random Forest Models
  + 2 Modes (same approach that you already did with RFR):
    - Average data
    - Frame sequence data
  + 3 inputs:
    - OpenFace
    - MediaPipe
    - Audio

Levan is doing [03/20/2023]: LSTM - same flow as Hinal’s.  
**<<<FOR SINGLE INPUT (NON FUSED)>>>**

| **Model Names** | **Input** | **Mode** | **Progress** | **DUE** |
| --- | --- | --- | --- | --- |
| RFR | OpenFace | average | **COMPLETED** | 03/22/2023 |
| RFR | OpenFace | frame sequence | **ONGOING** | 03/22/2023 |
| RFR | MediaPipe | frame sequence | **ONGOING** | 03/22/2023 |
| RFR | Audio | average | **ONGOING** | 03/22/2023 |
| RFR | Audio | pitch based | **ONGOING** | 03/22/2023 |
| SVM | OpenFace | average | **ONGOING** | 03/28/2023 |
| SVM | OpenFace | frame sequence | **ONGOING** | 03/28/2023 |
| SVM | MediaPipe | frame sequence | **ONGOING** | 03/28/2023 |
| SVM | Audio | average | **ONGOING** | 03/28/2023 |
| SVM | Audio | pitch based | **ONGOING** | 03/28/2023 |
| LSTM+2Dense | OpenFace | frame sequence | **ONGOING** | 03/20/2023 |
| LSTM+2Dense | MediaPipe | frame sequence | **ONGOING** | 03/20/2023 |
| LSTM+2Dense | Audio | pitch based | **ONGOING** | 03/20/2023 |

Visualizations:

- OpenFace: Hinal - due [**04/03/2023]**  
 - MediaPipe: Shreya - due [**04/03/2023]**  
 - Audio + Pitch: Levan - due [**04/03/2023]**

**For fused:**

| **Model Names** | **Input** | **Mode** | **Progress** | **DUE** |
| --- | --- | --- | --- | --- |
| RFR | openFace+audio | fused, averaged | **ONGOING** | 03/31/2023 |
| RFR | openFace+audio | fused, sequence | **ONGOING** | 03/31/2023 |
| RFR | medpipe+audio | fused, averaged | **ONGOING** | 03/31/2023 |
| RFR | medpipe+audio | fused, sequence | **ONGOING** | 03/31/2023 |
| SVM | openFace+audio | frame, averaged | **ONGOING** | 03/31/2023 |
| SVM | openFace+audio | frame, sequence | **ONGOING** | 03/31/2023 |
| SVM | medpipe+audio | frame, averaged | **ONGOING** | 03/31/2023 |
| SVM | medpipe+audio | frame, sequence | **ONGOING** | 03/31/2023 |
| LSTM | openFace+audio | frame sequence | **ONGOING** | 03/31/2023 |
| LSTM | medpipe+audio | frame sequence | **ONGOING** | 03/31/2023 |

Week 3: 03/12/2023 - 03/18/2023 (Team meeting on 03/10/2023):

* Presentation discussion:
  + TBD
* Model evaluation (Metrics includes: confusion matrix, accuracy, precision, recall, f1-score) - [Shreya] - due **04/02/2023**
* Model evaluation (Metrics includes: confusion matrix, accuracy, precision, recall, f1-score) - [Hinal] - due **04/02/2023**
* Model evaluation (Metrics includes: confusion matrix, accuracy, precision, recall, f1-score) - [Levan] - due **04/02/2023**

Week 4: 03/18/2023 - 04/04/2023 (Team meeting on 03/10/2023):

* Slides include:
  + Introduction
  + TBD

What we must complete by Monday 11:59pm [Levan & Shreya], [Thursday for Hinal].

- All models for single inputs (non fused ones) must be trained

- each model must be evaluated on at least following metrics:

- Accuracy.

- Precision.

- Recall.

- Confusion Matrix plot.

- LSTM only:

- besides training, features must be extracted and used for:

- KNN + UMAP plots.

- KNN unsupervised prediction.

- EDA [Shreya, Hinal, Levan]

- GitHub reorganization [Levan]

- Audio Correction [Levan]

**Phase 3 Execution & Interpretation - due 05/16/2023**

Front end implementation.

Dash Plotly UI - <https://dash.gallery/self-driving/>.

Demo Playthroughs from camera input.

Week 1: TBD.

extract pitch from audio - melspectrogram

