

SC310005 Artificial Intelligence

Lecture 13: AI Final Project

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Poster and Oral Presentation

Submit your AI project by providing its Title, Description, and Dataset through the Google Sheets link provided. Projects will be assigned on a first-come, first-served basis, ensuring that there are no duplicates.

<https://docs.google.com/spreadsheets/d/18tur5UXjUjxgegQziECyGpKikS-WqRwj2QNNIIYX9Bs/edit?usp=sharing>

** Scientific posters should be oriented exclusively in the **vertical position**.

** Recommend using **a portrait A0 layout**.

This text could be the main title of your research

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2. Department of Psychology and Dynamic, Italy winter Squatton Building, Woods

Methods

PRIVILEGE THE METHODS SECTION AS MUCH AS POSSIBLE. THIS IS WHERE YOU CAN EXPLAIN YOUR METHODOLOGICAL DESIGN AND THE METHODS USED IN YOUR STUDY. THIS SHOULD BE A DETAILED SECTION, AS IT IS THE PRIMARY APPROACH TO PERSUADING PEOPLE OF YOUR RESEARCH.

1 2 3

Figure 1: A flowchart showing three steps. Step 1 shows a person at the top with three arrows pointing down to three circles labeled 'POPULATION 1', 'POPULATION 2', and 'POPULATION 3'. Step 2 shows a person at the top with three arrows pointing down to three circles labeled 'POPULATION 1', 'POPULATION 2', and 'POPULATION 3'. Step 3 shows a person at the top with three arrows pointing down to three circles labeled 'POPULATION 1', 'POPULATION 2', and 'POPULATION 3'.

Results

What answer was found to the research question; what did the study find? Was the tested hypothesis true? Explain what the authors found following the method previously suggested. You should present your findings as clearly as possible. Present the data in a logical and organized way using tables, graphs, and charts as appropriate. Make sure to label all figures clearly and provide a brief caption that explains what is being shown.

Use visual aids such as graphs, charts, and tables to present your data. These should be clearly labeled and explained.

When presenting numerical data, don't forget to quantify the results. When presenting numerical data, be sure to provide the reader with statistics, such as means, standard deviation, and confidence intervals.

Figure 2: A box titled 'First chart heading' containing a pie chart with three segments: 'A' (blue), 'B' (red), and 'C' (green). Below the chart is the caption 'Figure 2: Three equal areas are represented by the three segments of the pie chart.'

Figure 3: A box titled 'Second chart heading' containing a bar chart with four bars labeled 'A', 'B', 'C', and 'D'. Below the chart is the caption 'Figure 3: Four equal areas are represented by the four bars of the bar chart.'

Provide context. If any result is perplexed, provide context by explaining what it means and how it relates to the research question or theories being investigated.

» In conclusion, I focus on presenting the data directly without any interpretation. The goal is to present the findings clearly and accurately, without drawing conclusions or making recommendations. Save any interpretation of the results for the discussion section. Finally, don't forget that I picture a scientist who, unlike me, is more interested in the data than in the conclusions and may ignore your argument.

Discussion

Began the discussion section by reiterating the main findings of your research question and objectives.

Sums up the key findings of your study in a few sentences. Avoid repeating the results section. Discuss the implications of your findings and what they mean in the context of the research question or hypothesis being investigated.

THE COULD BE A SECTION OF THE DISCUSSION

Compare your findings with those from previous research in the field. Explain why your research is different. If there are differences, are they important or irrelevant?

Discuss the limitations of your study, including any potential sources of error or bias. Be honest and transparent about the limitations of your study. This will help build credibility and trust in your research.

Discuss the implications of your findings for theory and practice in the field. Explain why your research could potentially be applied in the real world. Could you also place your potential future research directions.

Introduction

The introduction of a research poster should provide a brief overview of the topic and the purpose of the research. It should also include the following:

- providing some background information on the topic;
- clearly stating the research question or hypotheses;
- a brief summary of the methods used.

The introduction should be concise, informative, and engaging to capture the reader's attention.

Finally, outline the objectives of your research. This should be a clear statement of what you are hoping to achieve through your research, and should lead the guide to success through the rest of the poster.

THIS COULD BE A SECTION OF THE METHODS

Please describe the participants or subjects used in your study. Include their age, gender, ethnicity, and any other relevant characteristics.

Figure 4: A scatter plot with data points forming a triangle. The x-axis is labeled 'Age' and the y-axis is labeled 'Height'. A legend indicates 'Male' (blue) and 'Female' (red). A regression line is drawn through the data points.

Figure 5: A line graph with four lines labeled 'A', 'B', 'C', and 'D'. The x-axis is labeled 'X' and the y-axis is labeled 'Y'. The lines show a general downward trend.

Figure 6: A box titled 'Figure 6' containing a 3D scatter plot of spheres of varying sizes. The caption reads 'Figure 6: Three-dimensional scatter plot showing the relationship between size and position.'

Overall, the results section should be brief and to the point. The most important thing is to highlight the most important findings so that is what the reader remembers. Using visuals can be very effective in presenting data. When highlighting key findings can help to draw the reader's attention to the most important information.

Conclusion

- Summarize your final conclusions; reiterate the main findings;
- The implications of the results for theory and practice. I like going along those lines;
- In conclusion, this study highlights the importance of ... and provides a foundation for further research.

The findings suggest that X has a significant effect on Y. Let me explain why this might be mediated by certain possible mechanisms. The study has some limitations, but the implications of the findings are significant and far-reaching. Overall, this study contributes to the knowledge base in the field and may pave the way for further discoveries.

References

- Smith, J. A. & Brown, G. (2005). The Impact of Pricing Decisions. *Journal of Marketing Inquiry*, 14(2), 123-135.
- Johnson, M. (2010). The Impact of Marketing Decisions on Consumer Behavior. *Journal of Marketing Research*, 47(3), 123-135.
- Anderson, J. C. & Gerbing, D. W. (1988). Structural Equation Modeling in Practice: An Introduction to the Techniques and Applications. *Academy of Marketing Science Review*, 16(3), 17-39.
- Sheth, J. N., & Paranam, G. (2005). The Impact of Segmental Segmentation on American Spending. *Journal of Product Innovation Management*, 22(3), 217-238.

This image shows a person's hand holding a research poster. The poster has a white header with a dark blue border. The title 'This text could be the main title of your research' is in large, bold, black font. Below the title is a sub-section 'Methods' with a small icon. The body of the poster is divided into several sections: 'Results' (with a chart icon), 'Discussion' (with a chart icon), 'Conclusion' (with a chart icon), and 'References' (with a QR code icon). Each section contains a brief description of what should be included in that part of the poster.

This text could be the main title of your research

Mario Brusato¹, Bowser Baddy², Shoe Back³

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Introduction

The introduction of a research poster should provide a brief overview of the study's purpose and the hypothesis or research question that it is intended to address.

- proposing some background information on the topic;
- stating the research question or hypothesis;
- explaining why the research is important.

The introduction should be concise, informative, and engaging to capture the reader's attention.

Finals, outline the objectives of your research. This should be a clear statement of what you want to accomplish, why it is important, and should help to guide the reader through the rest of the poster.

Methods

PROVIDE THE DESIGN

Begin the methods section with an overview of the experimental design and methodology used. This section should help the reader understand the overall approach taken in your research.

1 2 3

RESULTS

What answer was found to the research question; what did the study find? Was the tested hypothesis true? Explain what the authors found following the method previously suggested. You should present your results as objectively as possible. Present the data in a logical and organized way, using tables, graphs, and charts as appropriate. Make sure to label all figures clearly and provide a brief caption that explains what is being shown.

Don't forget to Quantify the results. When presenting numerical data, be sure to include the mean, standard deviation, and standard error of the statistics, such as means, standard deviations, or *t*-tests.

Figure name: Figure 1: Box plot showing mean and standard deviation for three groups.

Figure name: Figure 2: Line graph showing mean and standard deviation over three time points.

Figure name: Figure 3: Scatter plot showing individual data points and a regression line.

RESULTS

Provide context - For each result presented, provide context by explaining what it means and how it relates to the research question or hypothesis being investigated.

» It's important to focus on presenting the data objectively and without interpretation. The goal is to present the findings clearly and accurately, without drawing conclusions or making recommendations, yet settle for just *data*? Make it memorable with visuals and engage your audience!

DISCUSSION

Begin the discussion section by reminding the reader of the main findings and their implications.

Discuss the key findings of your study in a sentence. Avoid repeating the results section. Discuss the implications of your findings and what they mean in the context of the research question or hypothesis being investigated.

THIS COULD BE A SECTION OF THE DISCUSSION

Compare your findings with those from previous research in the field. Discuss similarities, differences, and any inconsistencies or contradictions.

Discuss the limitations of your study, including any potential sources of error or bias. Be honest and transparent about the limitations of your research. But also explain how they can be addressed in future studies.

Discuss the implications of your findings for theory and practice in the field. Explain how your research could potentially be applied in real-world contexts. You can also state any potential future research directions.

CONCLUSION

Summarize the main findings. Interpret the main findings.

The implications of the research for theory and practice. It could go along those lines:

- In conclusion, this study highlights the importance of X in understanding Y and provides a foundation for future research in this area.

The findings suggest that X has a significant effect on Y, and that this effect may be mediated by English reading skills. These findings have important implications for clinical practice and public health policy. Overall, this study contributes to the knowledge base in the field and may pave the way for further discoveries.

REFERENCES

- Smith, J. A., & Doe, J. (2012). The Effects of Drinking Tequila Tacos on Human Langauge. *Journal of Tequila Research*, 3(2), 15-20.
- Snowden, L., & Caron MC, R. (2002). The Name is Bringin' Home: A Study of White and Black Adolescents' Perceptions of Rap Music. *Journal of Black Psychology*, 28(2), 175-190.
- Supernatural Strength. *Journal of Superhero Psychology*, 37(2), 75-88.
- On the Importance of Being Energetic. *Journal of Physical Activity*, 45(3), 231-240.
- How to Make Your Own Superhero Shirts. *Journal of Superhero Psychology*, 39(1), 15-26.

This text could be the main title of your research
If needed this could be a subtitle section

Mario Brostot¹, Bowser Baddy², Shoe Back³
¹ Department of Learning service, Novant Health Carolinas Hospital and Research Center, Mecklenburg, North Carolina, USA
² Department of Learning service, Novant Health Carolinas Hospital and Research Center, Mecklenburg, North Carolina, USA
³ Department of Learning and Right Brains, the Underdogg Academy, Mecklenburg, North Carolina, USA

1 Introduction

Begins your introduction with a general statement that provides an overview of your research topic. This statement should help to introduce the topic to the reader and provide some context.

- Provide background information: provide some background information on your topic. This includes the history of the topic, how it has evolved over time, and what have been the most important findings related to your research.
- State the problem: Once you have provided some context, state the problem that your research is addressing. This should be a clear and concise statement that defines the focus of your research.
- Outline the objectives: Explain why you are conducting the research, and how it will contribute to the field. This includes the specific goals and objectives of your research, and how it will address the problem or question you have identified.
- Provide a hypothesis: Finally, outline the key hypothesis of your research, and how it relates to the overall goal of your study. This should be a clear and concise statement that defines the purpose of what you are hoping to achieve through your research, and should help to guide the reader through the rest of the paper.

The box below could be a summary of the introduction. You can use keywords or only state the objectives of your research. The introduction should help the reader understand the overall approach taken in your research.

2 Methods

Provide an overview. Begin the methods section with an overview of the experimental design undertaken. This should help the reader understand the overall approach taken in your research.

THIS COULD BE A SECTION OF THE METHODS
 Hypotheses and methods: Outline the participants or subjects used in your study, including relevant demographic information such as age, sex, and any other relevant characteristics.

Population: The population used in our study was a sample of patients with hypertension who were recruited from our clinic. We included all patients aged 18-65 years who met the inclusion criteria and excluded those with contraindications to antihypertensive drugs.

Procedure: All participants underwent a physical examination, including blood pressure measurement, heart rate, and electrocardiogram. Blood samples were drawn for laboratory analysis, including serum glucose, lipid profile, and renal function tests. A 24-hour urine collection was performed to assess proteinuria. ECG was performed to rule out any arrhythmias.

Data analysis: Descriptive statistics were used to summarize the data, including mean, standard deviation, and range. Statistical analysis was performed using SPSS version 25.0. A p-value of less than 0.05 was considered statistically significant.

3 Results

What answer was found to the research question; what did the study find? Was the tested hypothesis supported? If so, how? If not, why not? What method previously suggested was shown present your results as objectively as possible.

Figure name

Use visual aids such as graphs, charts, or tables to present your findings. Each figure should be clearly labeled and easy to understand. Don't forget to quantify the results. When presenting numerical data, be sure to provide the reader with the relevant statistics, such as means, standard deviations, or p-values.

Chart first name

Figure A: Results are very interesting. The chart shows a significant increase in heart rate during exercise compared to baseline.

Chart second name

Figure B: These results are also very interesting. The chart shows a significant decrease in blood pressure during exercise compared to baseline.

4 Conclusion

Summary of your conclusions. Recapitulate the main findings and the implications of the research for theory and practice. Could go along these lines:

1. Recount the main findings of the research, highlighting the most important findings and their significance for future research in this area.

2. Explain the mechanisms by which the effect occurs (if any) and that the effect is mediated by [explain possible mechanism]. The study has some limitations, but the implications of the findings are significant and may contribute to the knowledge base in the field and may pave the way for further discoveries.

References

- Sarkar, J., & Dose, J. D. (2022). The Effects of Drinking Licorice Tea on Human Lengthy. *Journal of Medical Research*, 10(1), 1-10.
- Thompson, L., & Garroway, S. (2022). The Human Lengthy: A Bit of Risk and Benefits. *Journal of Medical Research*, 10(2), 11-20.
- Yilmaz, M., & Yilmaz, M. (2022). The Human Lengthy: Catch All. *Journal of Medical Research*, 10(3), 21-30.
- Yilmaz, M., & Yilmaz, M. (2022). The Human Lengthy: A Bit of Risk and Benefits. *Journal of Medical Research*, 10(4), 31-40.
- Yilmaz, M., & Yilmaz, M. (2022). The Human Lengthy: A Bit of Risk and Benefits. *Journal of Medical Research*, 10(5), 41-50.
- Yilmaz, M., & Yilmaz, M. (2022). The Human Lengthy: A Bit of Risk and Benefits. *Journal of Medical Research*, 10(6), 51-60.

Provide context: For each result presented, provide context by explaining what it means and how it relates to the research question or hypothesis being investigated.

This text could be the main title of your research
If needed this could be a subtitle section

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1 Introduction

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- Provide background information: provide some background information on your topic. This includes the history of the topic, how it has evolved over time, and what have been the most important findings related to your research.
- State the problem: Once you have provided some context, state the problem that your research is addressing. This should be a clear and concise statement that defines the focus of your research.
- Outline the objectives: After stating the problem, explain why it is important. Discuss the potential implications of your research and how it could contribute to the field.
- Outline the hypothesis: Finally, outline the key hypothesis of your research. This should be a clear and concise statement that defines the purpose of what you are hoping to achieve through your research, and should help to guide the reader through the rest of the paper.

The box below could be a summary of the introduction. You can use keywords or only state the objectives of your research. The introduction should help the reader understand the overall approach taken in your research.

Figure name

Avoid interpretation in the result section

Overall, the results section should be organized, clear, and concise, presenting the most important findings in a way that is accessible to the reader. Using tables and figures (using vectors) can be very effective in presenting complex data, and highlighting key findings can help the reader quickly identify the most important information.

Figure name

Avoid interpretation in the result section

Remember that the caption should be brief and to the point, providing just enough information for the audience to understand the context of the graph or figure. You should also be cautious:

- Don't use jargon.
- Avoid interpretation in the result section
- Don't include too much detail.

2 Methods

Provide an overview. Begin the methods section with an overview of the experimental design and objectives. This will help to frame the discussion in the context of the study and guide your analysis of the results.

THIS COULD BE A SECTION OF THE METHODS
 Participants or subjects: Now, provide details on the participants or subjects used in your study. Include relevant demographic information such as age, sex, and any other relevant characteristics.

Population: This population used in our study was a sample of patients with hypertension who were recruited from our clinic. We included all patients aged 18-65 years who met the inclusion criteria and excluded those with contraindications to antihypertensive drugs.

Procedure: All participants underwent a physical examination, including blood pressure measurement, heart rate, and electrocardiogram. Blood samples were drawn for laboratory analysis, including serum glucose, lipid profile, and renal function tests. A 24-hour urine collection was performed to assess proteinuria. ECG was performed to rule out any arrhythmias.

Data analysis: Descriptive statistics were used to summarize the data, including mean, standard deviation, and range. Statistical analysis was performed using SPSS version 25.0. A p-value of less than 0.05 was considered statistically significant.

3 Discussion

Begin the discussion section by reminding the reader of the main research question and objectives. This will help to frame the discussion in the context of the study and guide your analysis of the results.

THIS COULD BE A SECTION OF THE DISCUSSION
 Summary of your findings: In a few sentences, Avoid repeating the results section. This should provide a brief overview of the most important results and highlight the key findings. It should also discuss how these results relate to the rest of the research question or hypothesis being investigated.

Comparison with previous studies: Compare your findings with those from previous research in the field. Discuss similarities, differences, and any inconsistencies or contradictions.

THIS COULD BE ANOTHER SECTION OF THE DISCUSSION
 Limitations of your study: If your research involved the use of methods or apparatus, provide details on what these were, how they were prepared or calibrated, and how they were used.

- Procedure: Describe the procedures used in your study in detail, including any instructions given to participants or subjects, any specific protocols followed, and any measurements taken.
- Data analysis: Finally, provide information on how the data was analyzed, including any statistical methods used and how the data was presented or visualized.

Conclusion: Overall, the discussion section should be a thoughtful and reflective analysis of your results. It should interpret the findings in the context of previous research, discuss limitations and potential future directions, and highlight the practical implications of your research.

THIS COULD BE ANOTHER SECTION OF THE DISCUSSION
 Future research directions: Discuss the implications of your findings for theory and practice and list any future research questions that could be explored in real-world contexts and any potential future research directions.

Conclusion: Overall, the discussion section should be a thoughtful and reflective analysis of your results. It should interpret the findings in the context of previous research, discuss limitations and potential future directions, and highlight the practical implications of your research.

THIS COULD BE A SECTION OF THE CONCLUSION
 Summary of your key conclusions: Recapitulate the main findings and the implications of the research for theory and practice. Could go along these lines:

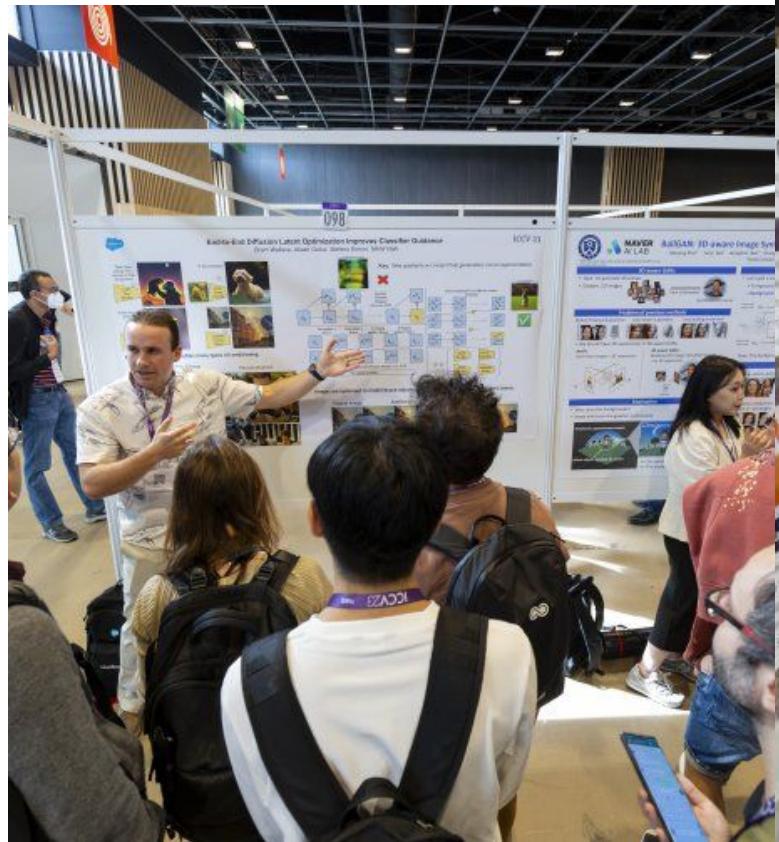
The results of this study support the hypothesis that [insert hypothesis] is effective in [insert outcome]. The results also suggest that [insert outcome] is associated with [insert outcome]. The results of this study provide new insights into the mechanism by which [insert mechanism] works. The results of this study also highlight the importance of [insert outcome] for [insert outcome]. The results of this study also highlight the importance of [insert outcome] for [insert outcome]. The results of this study also highlight the importance of [insert outcome] for [insert outcome].

Conclusion: Overall, the conclusion section should be a thoughtful and reflective analysis of your results. It should interpret the findings in the context of previous research, discuss limitations and potential future directions, and highlight the practical implications of your research.

References

- Sarkar, J., & Dose, J. D. (2022). The Effects of Drinking Licorice Tea on Human Lengthy. *Journal of Medical Research*, 10(1), 1-10.
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Provide context: For each result presented, provide context by explaining what it means and how it relates to the research question or hypothesis being investigated.





Applying deep learning classification for tumor identification across immunohistochemical markers on serial sections to eliminate the need for image co-registration

Mark Anderson, Lorcan Sherry, Matthew Corser, Alison Bigley
OracleBio, Biocity Scotland, UK



Sample:

[https://oraclebio.com/posters/
sitc-poster-deep-learning-tum
or-classification/](https://oraclebio.com/posters/sitc-poster-deep-learning-tum-or-classification/)

Background

Artificial intelligence deep learning networks are being increasingly applied to resolve complex pattern recognition challenges in quantitative digital pathology. Khosravi^[1] utilized deep learning to discriminate and classify tumors and associated subtypes using a range of immunohistochemically (IHC) labelled tumor sections, even where tumors were significantly heterogeneous.

Image co-registration is commonly employed in brightfield quantitative workflows where serial sections have been IHC labelled with different markers, one of which is a tumor marker, such as pan-Cytokeratin (panCK), which is used to guide the tumor locations in the corresponding serial section.

Frequently, when applying the co-registration, region of interest (ROI) alignment errors may occur, in particular at the periphery of tumor foci where either tumor cells are missed, or adjacent stroma is incorrectly classified as tumor.

Deep learning classifiers can be trained across a range of sections and markers to define tumor, utilizing a range of features from each stained sample to generate a classifier capable of identifying tumor ROI independent of the tissue, stain or marker.

Here we use serial tissue microarray (TMA) sections of gastric adenocarcinomas, labelled with either panCK or CD3, to exemplify the use of a deep learning approach to distinguish tumor foci without requiring serial section image co-registration.

Methods

Exemplar TMA serial sections of gastric adenocarcinomas (Biomax, Ref ST1921) were IHC labelled for either panCK or CD3, using DAB chromogen and counterstained with haematoxylin. The stained slides were digitized at x20 magnification using a Zeiss scanner. A tissue classifier algorithm was developed using the DeepLab3 network in Visopharm® Oncotopix® Software. Classes were established for viable tumor (orange), intertumoral stroma (blue) and background including white space, necrosis and muscle tissue (green). Training areas for each class were manually annotated at x10 input magnification on a selection of cores (n=95) across both IHC markers and used to train the first version of the classifier, which was then run across the training cores (Figure 1(A)).

The first pass overlays, on the 95 classified cores from both IHC markers, were then manually refined as optimised training areas and re-applied for approximately 120,000 iterations (training cycles) to attain an error rate of <5% (Figure 1(B)).

The final classifier was then run over each TMA containing 188 cores (Figure 1(C)). A Sørensen-Dice similarity coefficient (Figure 2) was generated over the 95 training cores to determine the level of correlation between manually annotated ROI and the final classified labelled outputs.

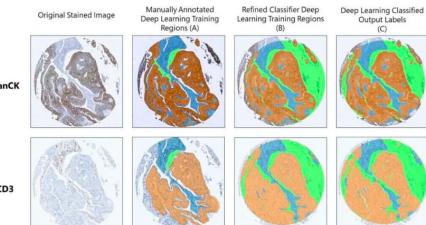


Figure 1: Tumor (orange), stroma (blue) and background (green) ROI of panCK and CD3 stained TMA cores.

$$DSC = \frac{2TP}{2TP + FP + FN}$$

DSC = Sørensen-Dice similarity coefficient
FP = area of false positive for that ROI
FN = area of false negative for that ROI
TP = True positive i.e. manual mark up and classifier label overlap

Figure 2: Sørensen-Dice similarity coefficient calculation

Results

Tumor and stroma were accurately identified across the serial sections using a single deep learning algorithm. Applying the Sørensen-Dice similarity coefficient across the 95 cores, to compare the original manually annotated ROIs to the ROI outputs from the deep learning classification (Table 1) confirmed a high-level correlation, i.e. >0.82, between manual ROI and deep learning classifications for both IHC markers.

Table 1: Dice score calculation per ROI per marker

Marker	Tumor	Stroma	Background
Cytokeratin	0.95	0.93	0.93
CD3	0.90	0.82	0.94

Figure 3 shows visually how the trained deep learning classifier performed on two representative cores (A and B), cores which were not used in the original training set.

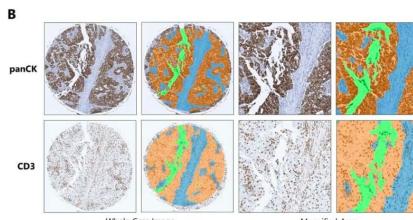
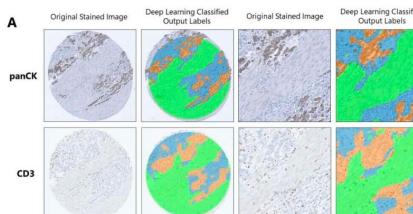


Figure 3: Tumor (orange), stroma (blue) and background (green) classified output labels on two exemplar panCK and CD3 stained TMA cores with corresponding magnified areas.

Conclusion

These exemplar data demonstrate the application of a single deep learning classifier, across IHC stained images, enabling the identification of tumor and stroma, irrespective of IHC marker. This approach has shown that it is possible to accurately utilize multifaceted features, from different IHC markers on TMA tissue sections, for the accurate classification of tumor and stroma ROI. This deep learning approach provides an alternative method to the co-registration of images for tumor assignment across serial sections.

1. Khosravi P, Kazemi E, Imielinski M, Elemento O and Hajirasouliha I. Deep Convolutional Neural Networks Enable Discrimination of Heterogeneous Digital Pathology Images. *EBioMedicine* 2018;27:317-328



Sample

<https://www.slideshare.net/ssuser3dc55e/nat-poster>



Deep-Learning based X-ray Image Classification for Quarantine Items: a Feasibility Study

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2. Program in Biomedical Radiation Sciences, Department of Transdisciplinary Studies, Graduate School of Convergence Science and Technology, Seoul National University, 08826, Seoul, Republic of Korea

3. Neutron and Radiosotope Application Research Division, Korea Atomic Energy Research Institute, 149-77, Daejeon, Republic of Korea

4. Advanced Institutes of Convergence Technology, Seoul National University, 16229, Suwon, Republic of Korea

(Corresponding author e-mail: yeo@smu.ac.kr)

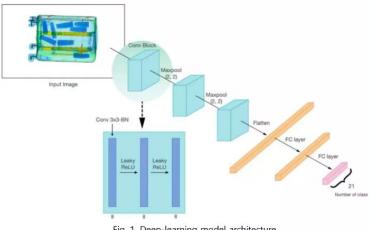
Introduction

- As the time goes by, the number of tourist are increasing and accordingly, Illegal imports of quarantine items are rising.
- Most of the quarantine imported items is still carried out through detection dogs or simple X-ray visual monitoring.
 - Fast and efficient X-ray image identification system is needed instead of simple visual monitoring
- Research Purpose : Investigate the applicability of the X-ray image recognition system using deep-learning for accurate X-ray search and identification of quarantine items.

Experimental details / Methods

- Collecting X-ray Image data (courtesy of Byung-Gun Park)
 - The X-ray image has 21 classes with 13 different scan types.
 - 21 classes : Pepper, Sesame, Dracaena, Lime, Banana, etc.
- Preprocessing (courtesy of Mungi Eom & Jimin Lee)
 - Label the images with 21 classes and resize all the images into same size.
 - Split data → train : validation : test = 8 : 1 : 1

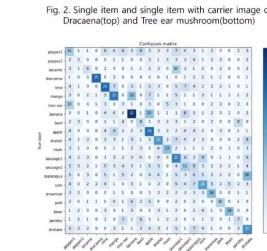
Model



- The proposed model has 3 convolutional block, 1 flatten layer and 2 fully connected layer.
- The convolutional block is consisted with 3 3x3 filter convolutional layer with leaky ReLU activation function.
- Loss function : Cross entropy function
- Optimizer : Adam optimizer
- Epoch : 125
- Learning rate : 0.0005, 0.0001, 0.00007, 0.00001
- Number of trainable parameter : 106,942,182

Results

- Overall accuracy through classes : 25.5%
- High accuracy : dracaena (67.57%), banana (42.67%)
- Low accuracy : tree ear mushroom (8.33%), asparagus (8.57%)



Discussion and Conclusions

- Since the object visibility depends on the shape and density of the object, the classes like tree ear mushroom and asparagus had bad visibility.
- The lack of number of images per scan type lead the model hard to generalize the different object shapes and its labels.
- Despite of the low overall accuracy, confusion matrix of the proposed model showed clear difference between each object, and tendency for classifying objects.
- The model have possibilities to be improved.

References

Acknowledgements / Funding support

This research was supported by a fund(Project Code No.PQ20205B030) by Research of Animal and Plant Quarantine Agency, South Korea

Sample

<https://medschool.duke.edu/news/student-researchers-share-what-they-know-about-ai-and-health>

Using Deep Learning to Classify Traumatic Brain Injury in CT Scans

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Health Data Science (HDS) Fall 2022 Student Research Program

Introduction

- Each year, 5 million Americans seek emergency medical care for traumatic brain injury (TBI).
- Computerized tomography (CT) scans are a key tool for diagnosis.

Fig. 1: A selection of three CT brain images. The most common are a measure of blood density.

TBI's complexity combined with variable decision-making, make diagnosis nontrivial.

Application of deep learning promises to standardize and sharpen diagnoses.

Datasets

- Models were developed for the CQ500 open-source dataset¹ and an internal dataset from Duke Hospital.
- For the **CQ500** dataset, intracranial hemorrhage (ICH) was trained due to its class balance.
- For the **Duke** dataset, a composite label was created from diagnoses for skull fracture and hematomas.

Fig. 2: A selection of three CT brain images. The most common are a measure of blood density.

Methods

- Both models were constructed with **pytorch**.
- Each model utilized slice-level information, while the Duke model was evaluated for both slices and volumes.

Fig. 3: Pipeline flow for the CQ500 and Duke models. Techniques explained, through either slice or 3D volume input.

Results

CQ500

- Decent performance was found at the slice level.
- Training curves not shown due to training overfitting.
- Promising, but the dataset was relatively homogeneous.

Fig. 3: CQ500 performance.

Duke

- The Duke scans are less standardized than CQ500's, likely causing a drop-off in performance.
- Classifying by volume based on averaging the top 5 slice scores per scan yielded small but viable improvement.

Fig. 4: Duke performance.

Acknowledgements

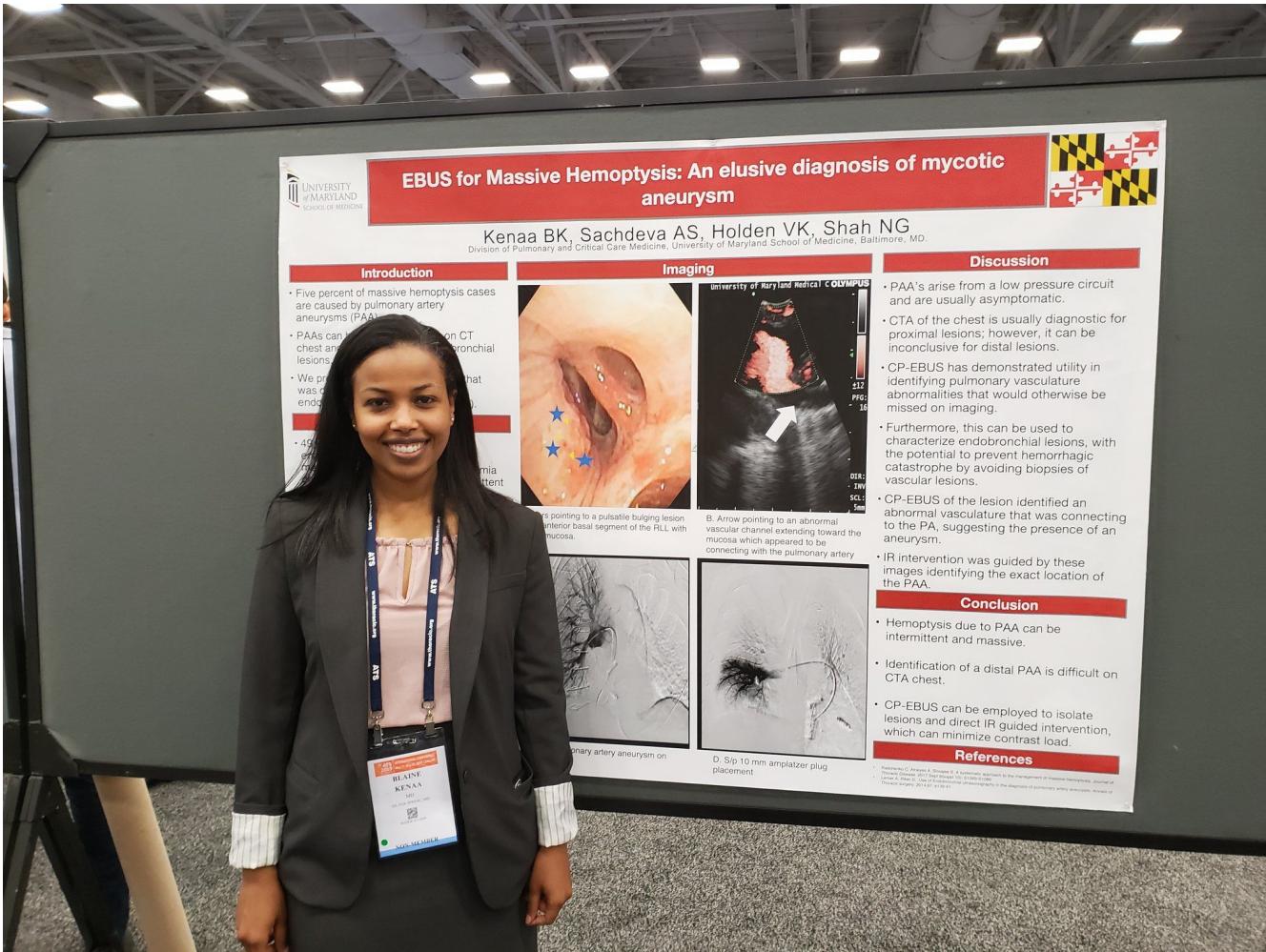
References

Medical image segmentation and classification for traumatic brain injury detection. This work was funded by the National Institute of Health (NIH) under award number R01NS092500. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH. The CQ500 dataset was obtained from the University of Colorado Boulder. The Duke dataset was obtained from the Duke Hospital. The authors would like to thank Dr. Michael D. Finsen for his support and guidance throughout this research.



Sample

<https://twitter.com/ksrobinett/status/130894250193895425>



Sample

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P437

A RA-re Cause of Obstructive Lung Disease

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²Department of Diagnostic Radiology, University of Maryland School of Medicine, Baltimore, MD
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Introduction

- Rheumatoid arthritis (RA) is a common autoimmune disease well-known for its inflammatory, destructive polyarthropathy.
- RA has many pulmonary manifestations, including airways disease.
- Smoking is highly prevalent among individuals with RA and may even be synergistic.
- Diagnosis and treatment of RA-related lung disease is often challenging due to competing comorbidities.

Case Presentation

History of Present Illness

- 57 year old Caucasian woman with RA referred for worsening dyspnea, hypoxia, and cough
- Previously diagnosed with COPD on LABA/ICS and supplemental oxygen
- RA: intermittent therapy with prednisone, mycophenolate, hydroxychloroquine, methotrexate, stem-cell therapy
- Significant smoking history (70 pack years, quit 20 years prior to presentation)
- Owner of 4 pet birds (parakeets)
- Occupational: cashier at a horse race track

Physical Exam

- Extremely thin, temporal wasting, enlargement of DIP and PIP joints bilaterally, mechanics hands
- Lung exam: inspiratory squawk, diffuse crackles, absence of wheezing

Laboratory Data

- Positive RF, ANA, SSA, aldolase, and IgG
- Negative CCP, SSB, Sm Ab, RNP Ab, ANCA
- Hypersensitivity panel: reactive pigeon antigen
- Peripheral eosinophils: 4.7%

Pulmonary Function Tests

	Pre-treatment	Post-treatment
FEV ₁ , L (% predicted)	0.83 (36%)	1.03 (44%)
FVC, L (% predicted)	1.24 (39%)	1.72 (55%)
FEV ₁ /FVC	68%	60%
TLC, L (% predicted)	5.01 (99%)	4.94 (97%)
RV, L (% predicted)	3.67 (190%)	3.22 (165%)
DlCO, ml/min/mmHg/min	8.6 (39%)	13.4 (61%)

Figure 1. Pulmonary function testing at baseline and two months post-treatment demonstrating a mixed obstructive and restrictive defect with air trapping and a severely reduced diffusion capacity.

Coronal CT Imaging

Axial CT Imaging

Expiratory

Figure 1. Axial images from a 2018 CT chest on inspiration, demonstrating mosaic attenuation in a diffuse distribution.

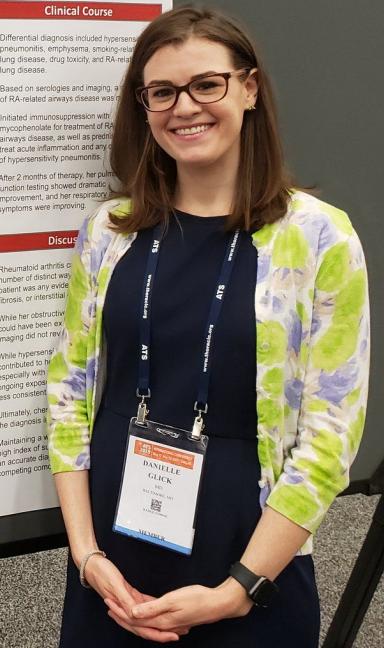
Figure 2. Coronal images from a 2015 CT chest, shown here in both inspiration and expiration, demonstrating mosaic attenuation especially during the expiratory phase, a finding consistent with air trapping and small airways disease.

Clinical Course

- Differential diagnosis included hypersensitivity pneumonitis, emphysema, smoking-related lung disease, drug toxicity, and RA-related lung disease.
- Based on serologies and imaging, a diagnosis of RA-related airways disease was made.
- Initiated immunosuppression with mycophenolate for treatment of RA and smoking cessation as well as preventive treatment against the development of hypersensitivity pneumonitis.
- After 4 months of therapy, her pulmonary function testing showed dramatic improvement, and her respiratory symptoms were improving.

Discussion

- Rheumatoid arthritis is often associated with a number of distinct way patient was any cause of fibrosis in the chest?
- What role did smoking have? It could have been ex-smoker but did not have imaging done.
- While hypersensitivity contributed to his especially with ongoing exercise, less consistent.
- Ultimately, chief complaint is the fibrosis.
- Maintaining a high index of suspicion for accurate diagnosis in competing conditions.



Sample

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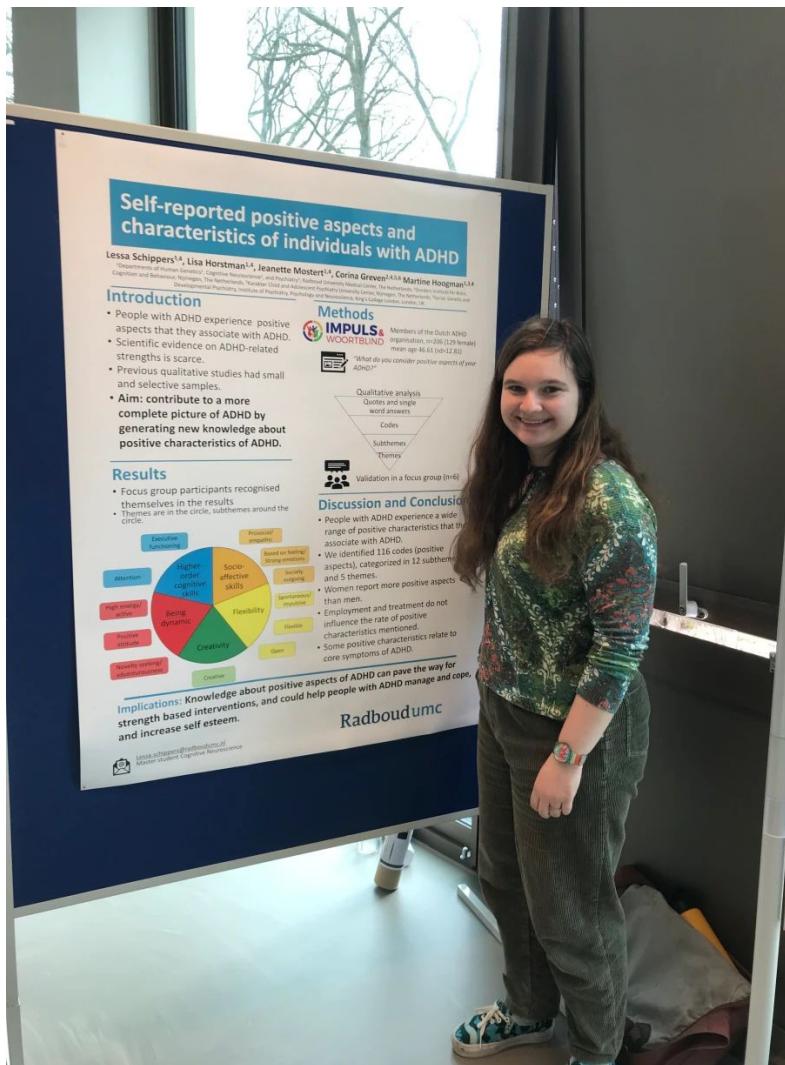
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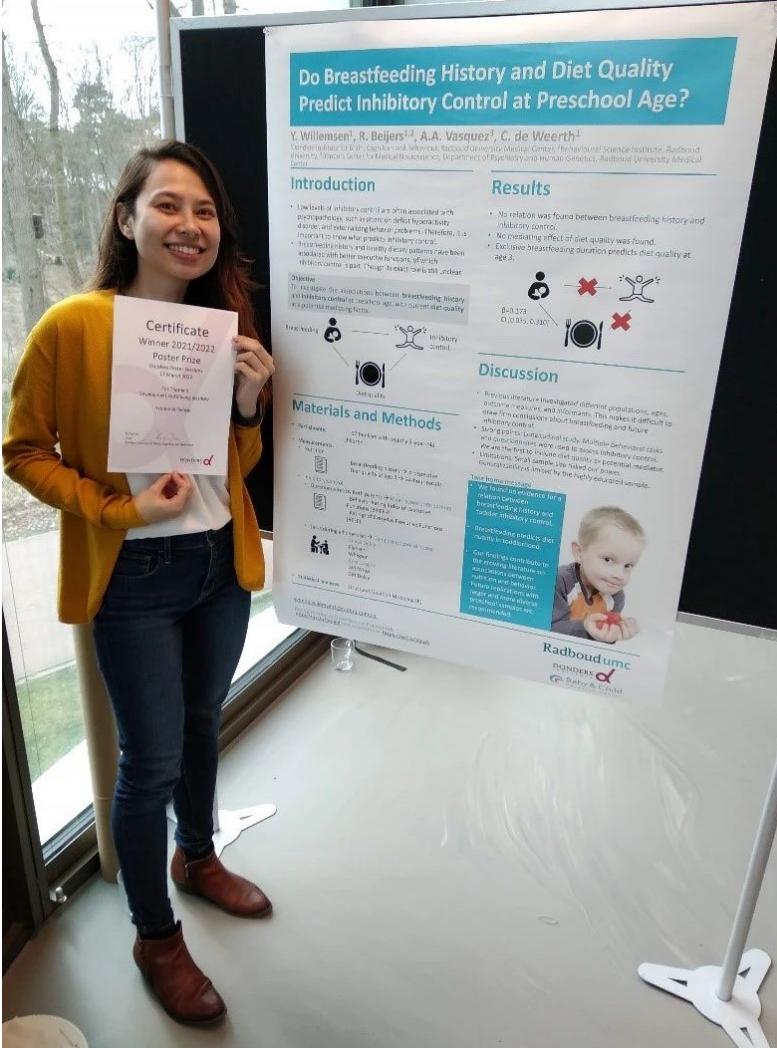
Sample

<https://martinehoogman.com/2022/03/23/student-lessa-presents-poster-at-donders-sessions/>



Sample

<https://dpblab.org/2022/03/17/donders-poster-session/>



Sample

<https://dpblab.org/2022/03/17/donders-poster-session/>

Do Breastfeeding History and Diet Quality Predict Inhibitory Control at Preschool Age?

Y. Willemsen¹, R. Beijers^{1,2}, A.A. Vasquez³, C. de Weerth¹

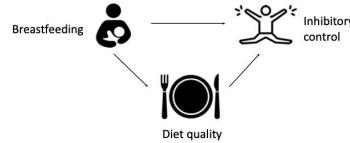
¹Donders Institute for Brain, Cognition and Behaviour, Radboud University Medical Center, ²Behavioural Science Institute, Radboud University, ³Donders Center for Medical Neuroscience, Department of Psychiatry and Human Genetics, Radboud University Medical Center.

Introduction

- Low levels of inhibitory control are often associated with psychopathology, such as attention deficit hyperactivity disorder, and externalizing behavior problems. Therefore, it is important to know what predicts inhibitory control.
- Breastfeeding history and healthy dietary patterns have been associated with better executive functions, of which inhibitory control is part. Though its exact role is still unclear.

Objective

To investigate the associations between breastfeeding history and inhibitory control at preschool age, with current diet quality as a potential mediating factor.

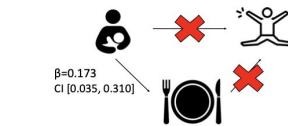


Materials and Methods

- Participants.** 67 families with healthy 3-year-old children.
- Measurements.**
 - Nutrition**
 - Breastfeeding history → prospective Diet quality at age 3 → 24-hour recalls
 - Inhibitory control**
 - Questionnaires** by both parents → Mean score both parents Behavior Rating Index of Executive Functions (BRIEF-P)
Ratings of Everyday Executive Functions (REEF)
 - Tasks during a home visit** → Composite score all tasks
Snack Delay
Flanker
Whisper
Bear Dragon
Gift Wrap
Gift Delay
 - Statistical analyses.** Structural Equation Modeling (R)

Results

- No relation was found between breastfeeding history and inhibitory control.
- No mediating effect of diet quality was found.
- Exclusive breastfeeding duration predicts diet quality at age 3.



Discussion

- Previous literature investigated different populations, ages, outcome measures, and informants. This makes it difficult to draw firm conclusions about breastfeeding and future inhibitory control.
- Strong points: Longitudinal study. Multiple behavioral tasks and questionnaires were used to assess inhibitory control. We are the first to include diet quality as potential mediator.
- Limitations: Small sample size risked our power. Generalizability is limited by the highly educated sample.

Take home message

- We found no evidence for a relation between breastfeeding history and toddler inhibitory control.
- Breastfeeding predicts diet quality in toddlerhood.
- Our findings contribute to the growing literature on associations between nutrition and behavior. Future replications with larger and more diverse preschool samples are recommended.



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Preregistration at Open Science Framework:
<https://osf.io/5mgmf> and amendment: <https://osf.io/35tg6>

Chanakya: Learning Runtime Decisions for Adaptive Real-Time Perception

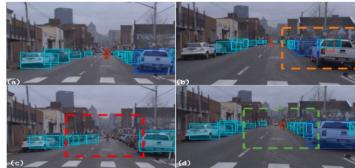
Anurag Ghosh, Vaibhav Balloli, Akshay Nambi, Aditya Singh, Tanuja Ganu

Microsoft Research



Problem

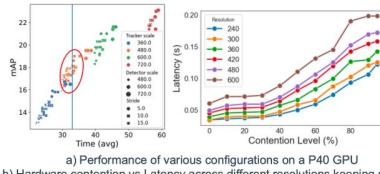
- a) Powerful detectors are accurate
- b) But powerful detectors are too slow for real-time perception
- c) Fast detectors are inaccurate
- d) Real-time perception systems need both fast and accurate models



Motivation

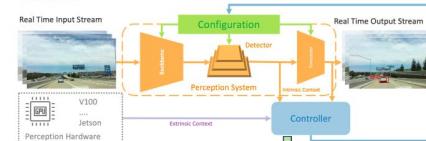
Can we choose the right configuration at runtime to improve streaming perception performance ?

- a) Different model configurations have different performance and latencies at runtime
- b) Latency has a non-linear relationship with hardware contention

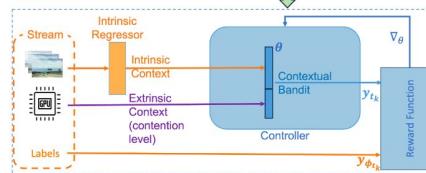


Chanakya

Overview



Controller



Proposed Reward Model

At each timestep, reward between times t_x and t_y is calculated as:

$$R(t_x, t_y) = L(\{y_{t_k}, \hat{y}_{\varphi(t_k)}\}_{k=x}^y)$$

L = arbitrary single frame loss between model output y_{t_k} and latest ground truth $\hat{y}_{\varphi(t_k)}$

$$R_{fixed_adv}(t_x, t_y) = R_\pi(t_x, t_y) - R_{\pi_{fixed}}(t_x, t_y)$$

Fixed advantage reward model used to train the controller given a fixed expert policy

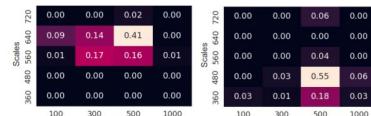
Key Insights

Significant sAP performance improvement

Method	sAP
Baseline	18.2
Chanakya	21.3
Offline Bound	24.3

- Outperforms SOTA static and dynamic baselines
- Can be applied to many real-time perception applications in the cloud and edge

Dynamic Selection of configurations based on environment context and hardware



Distribution of configurations chosen by Chanakya on P40 (server GPU – left) and b) Nvidia Xavier NX(edge GPU - right)

Adaptability to extrinsic context

- Outperforms SOTA static and dynamic baselines
- Can be applied to many real-time perception applications in the cloud and edge



Sample

<https://www.nature.com/articles/s41597-023-02482-8>

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Label-free tumor cells classification using deep learning and high-content imaging

Chawan Piansaddhayanon, Chonnuttida Koracharkornradt, Napat Laosaengpha, Qingyi Tao, Praewphan Ingrungruanglert, Nipan Israsena , Ekapol Chuangsuanich  & Sira Sriswasdi 

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Abstract

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[Data Records](#)
[Technical Validation](#)
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Label-free tumor cells classification using deep learning and high-content imaging

Chawan Piansaddhayanon^{1,2,3,8}, Chonnuttida Koracharkornradt^{2,8}, Napat Laosaengpha^{1,2}, Qingyi Tao⁴, Praewphan Ingrungruanglert⁵, Nipan Israsena^{5,6}✉, Ekapol Chuangsuanich^{1,2}✉ & Sira Sriswasdi ^{2,7}✉

Many studies have shown that cellular morphology can be used to distinguish spiked-in tumor cells in blood sample background. However, most validation experiments included only homogeneous cell lines and inadequately captured the broad morphological heterogeneity of cancer cells. Furthermore, normal, non-blood cells could be erroneously classified as cancer because their morphology differ from blood cells. Here, we constructed a dataset of microscopic images of organoid-derived cancer and normal cell with diverse morphology and developed a proof-of-concept deep learning model that can distinguish cancer cells from normal cells within an unlabeled microscopy image. In total, more than 75,000 organoid-derived cells from 3 cholangiocarcinoma patients were collected. The model achieved an area under the receiver operating characteristics curve (AUROC) of 0.78 and can generalize to cell images from an unseen patient. These resources serve as a foundation for an automated, robust platform for circulating tumor cell detection.

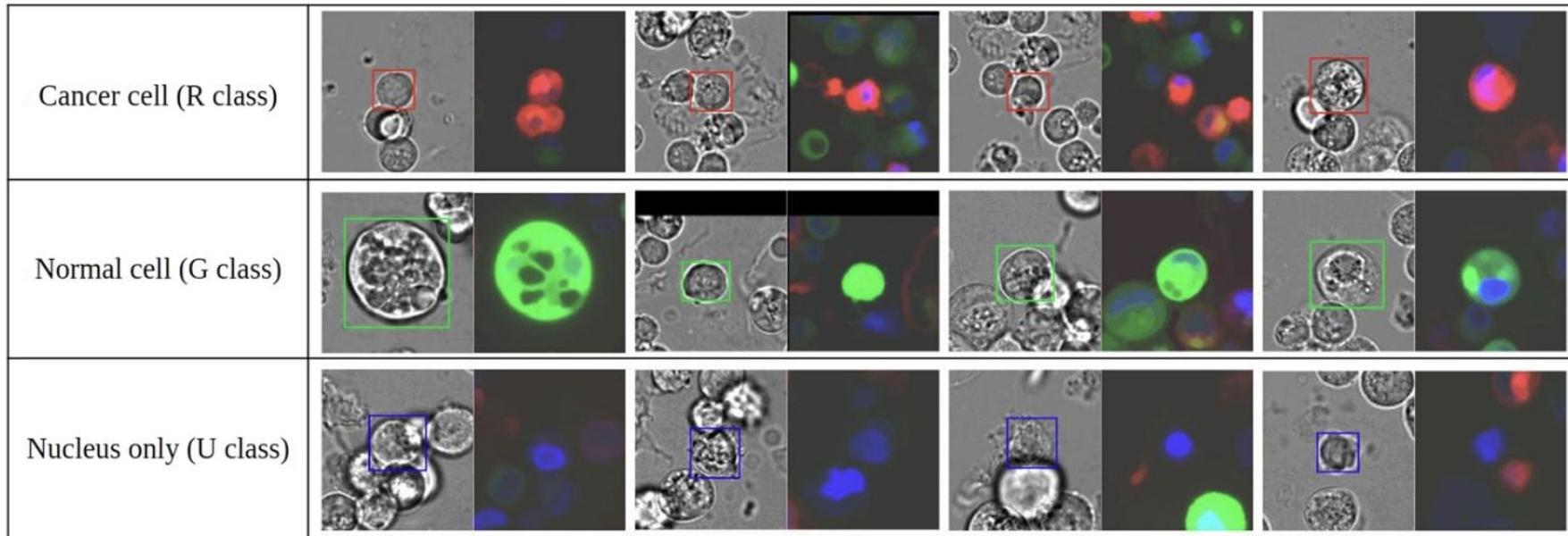


Fig. 2 Examples of annotated cells from each class.

Data Records

The dataset consists of 1207 paired brightfield and fluorescence microscopy images with a resolution of 1080×1080 in the TIFF format with cell-level bounding box and classification annotations in the VOC format. The dataset is available on FigShare²⁷. There are 84,503 cell-level bounding box annotations consisting of a bounding box (xmin, ymin, w, h), and object class. The three object classes are R, G, and U, which refer to tumor cell (red fluorescence), normal cell (green fluorescence), and unknown cell, respectively. The dataset is separated into training, validation, and test splits, where the test split contains only cancer cell annotation, while the rest have all three classes. The number of objects from each class in each data split is shown in Table 1.

Data split	No. of image	R	G	U
Train	967	22800	24862	24575
Validation	120	2823	2972	3135
Test	120	3336	(3374)	(3459)

Table 1. The number of images and cells in each dataset split. Numbers in brackets were estimated from model prediction results under the guidance of fluorescence signal. For reference, the average precision for R, G, and U class on the validation split is 89.2, 88.0, and 80.8, respectively.

Setting	F1	precision	recall	AUROC
Brightfield	60.5 ± 0.4	50.5 ± 0.6	75.5 ± 1.7	77.5 ± 0.2
Brightfield + Hoechst	66.0 ± 0.2	58.7 ± 0.9	75.5 ± 1.3	83.0 ± 0.2
Brightfield + Fluorescence	94.5 ± 0.1	93.5 ± 0.3	95.5 ± 0.1	99.3 ± 0.1

Table 2. Cell-level cancer classification performance of our method on the validation split of our dataset.

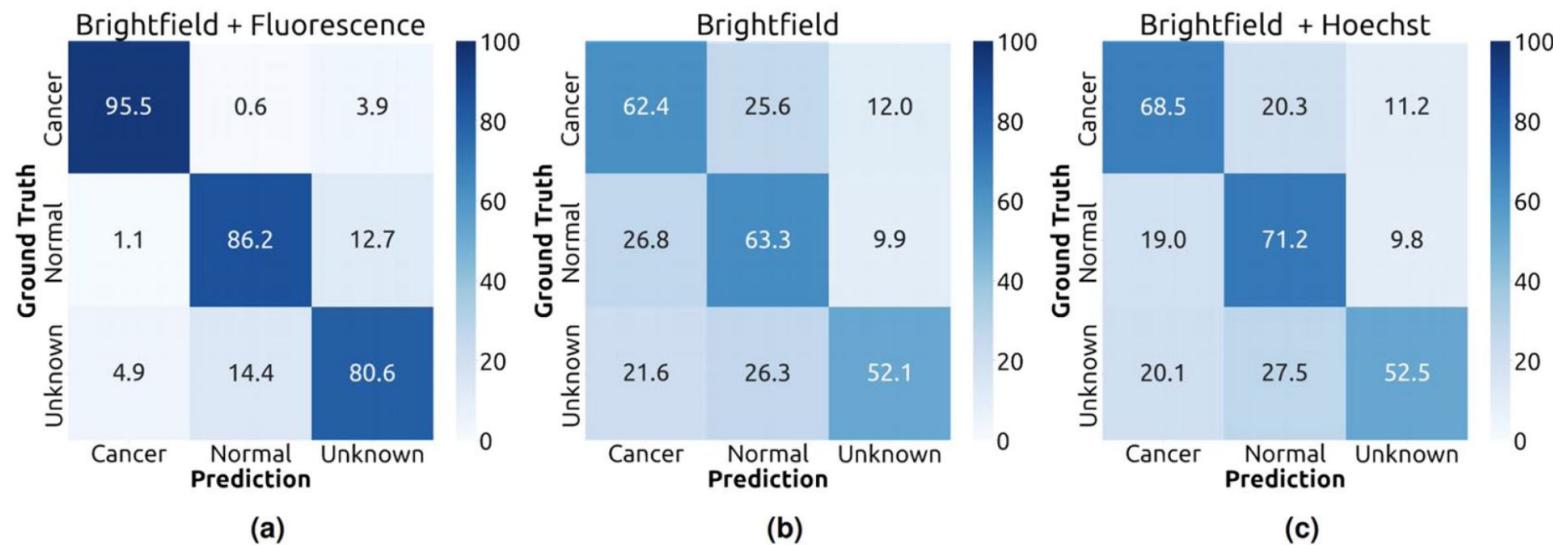
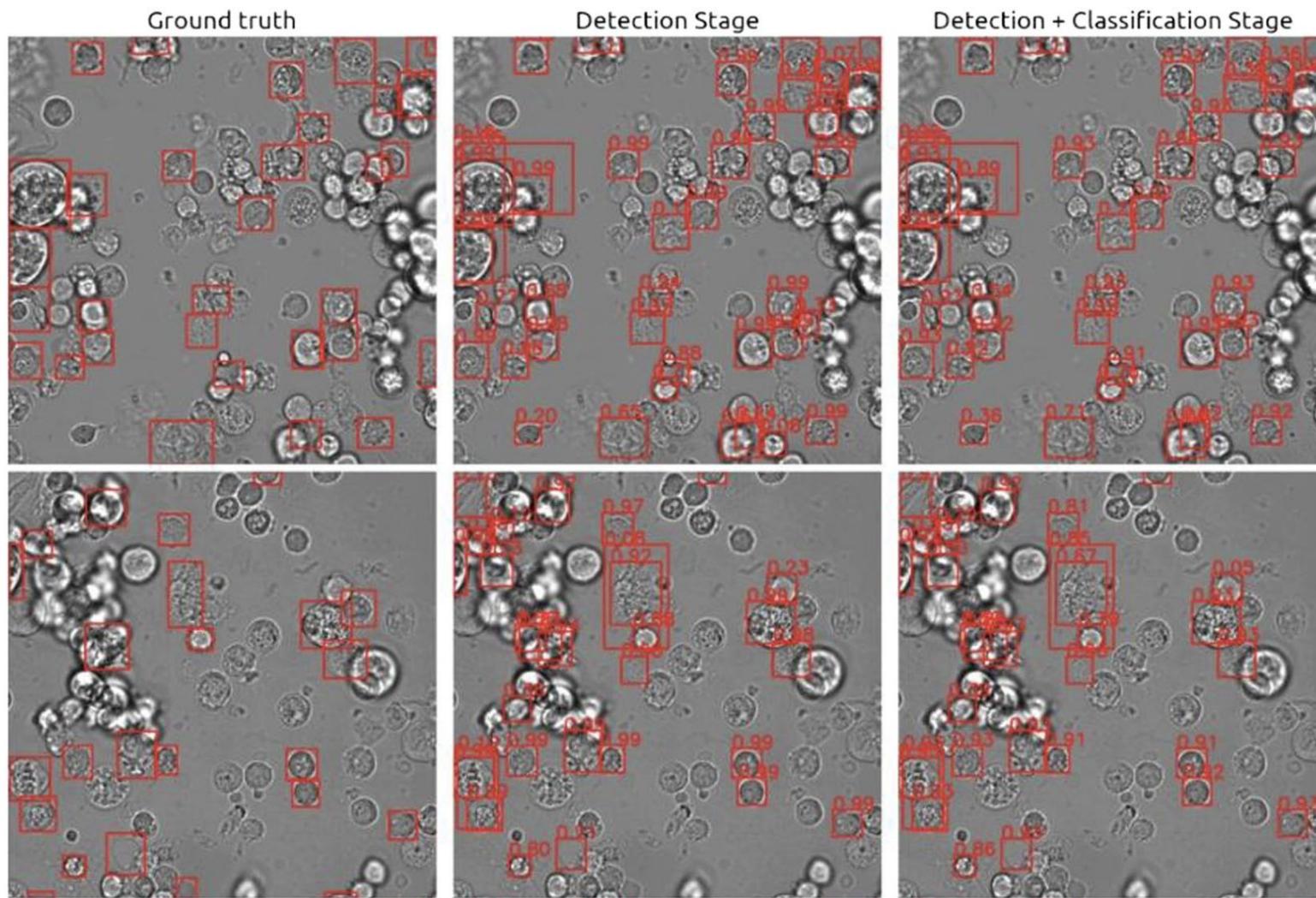


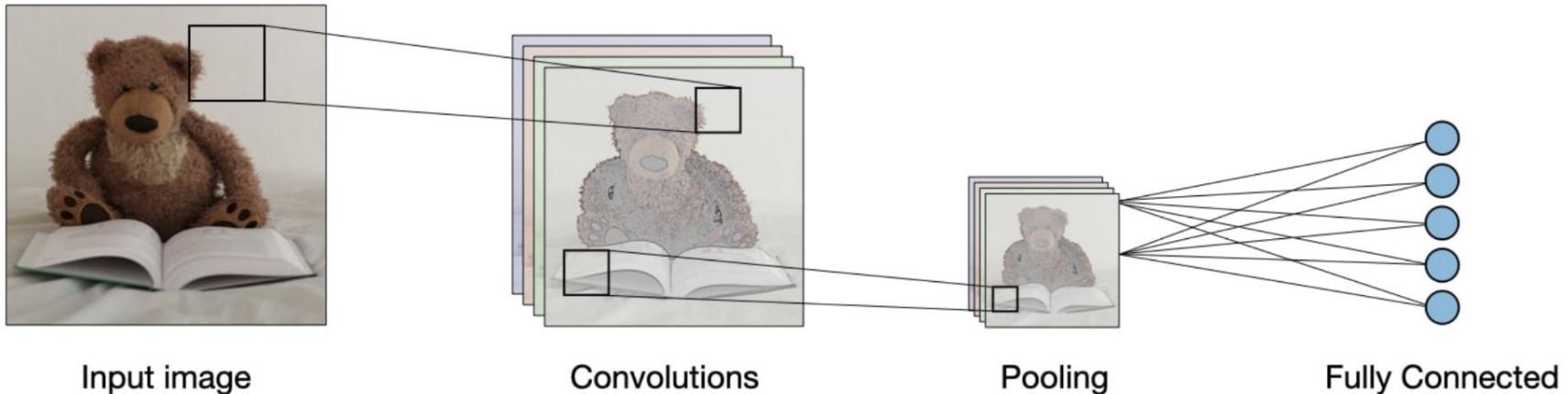
Fig. 7 Normalized confusion matrix of the cell-level evaluation on the validation split.

Backbone	#Params	Training time	Brightfield		Brightfield + Hoechst		Brightfield + Fluorescence	
			F1	AUROC	F1	AUROC	F1	AUROC
Swin-B ³⁸	86.7 M	2.80 h	59.9 ± 0.1	75.8 ± 0.1	66.2 ± 0.1	83.0 ± 0.1	94.6 ± 0.1	99.3 ± 0.1
Swin-S ³⁸	48.8 M	2.18 h	59.8 ± 0.3	77.1 ± 0.1	66.2 ± 0.1	83.0 ± 0.1	94.6 ± 0.1	99.3 ± 0.1
ConvNext-L ³³	196.2 M	1.30 h	61.0 ± 0.1	77.9 ± 0.2	66.4 ± 0.4	83.2 ± 0.2	94.5 ± 0.1	99.3 ± 0.1
ConvNext-B ³³	87.6 M	0.87 h	60.5 ± 0.4	77.5 ± 0.2	66.0 ± 0.2	83.0 ± 0.2	94.5 ± 0.1	99.3 ± 0.1
ConvNext-S ³³	49.5 M	0.75 h	60.2 ± 0.1	77.2 ± 0.1	65.8 ± 0.3	82.7 ± 0.2	94.6 ± 0.1	99.3 ± 0.1
EfficientNet-B7 ³⁶	63.8 M	1.30 h	60.3 ± 0.4	77.1 ± 0.2	65.1 ± 0.2	81.9 ± 0.2	94.5 ± 0.2	99.1 ± 0.2
EfficientNet-B4 ³⁶	17.6 M	0.81 h	60.0 ± 0.1	77.3 ± 0.2	65.2 ± 0.3	82.2 ± 0.1	94.4 ± 0.2	99.2 ± 0.1
EfficientNet-B1 ³⁶	6.5 M	0.71 h	59.1 ± 0.2	76.2 ± 0.2	63.4 ± 0.3	80.6 ± 0.1	94.4 ± 0.2	99.2 ± 0.1
DenseNet-201 ³⁷	18.1 M	1.23 h	60.0 ± 0.4	76.6 ± 0.2	64.6 ± 0.3	81.7 ± 0.3	94.5 ± 0.2	99.3 ± 0.1
DenseNet-169 ³⁷	12.5 M	0.94 h	59.5 ± 0.2	76.5 ± 0.2	64.8 ± 0.2	81.8 ± 0.1	94.2 ± 0.1	99.2 ± 0.1
DenseNet-121 ³⁷	7.0 M	0.75 h	59.3 ± 0.4	76.0 ± 0.3	64.2 ± 0.3	81.1 ± 0.2	94.4 ± 0.4	99.1 ± 0.1
ResNet-152 ³⁰	58.2 M	1.03 h	58.8 ± 0.2	75.7 ± 0.3	63.9 ± 0.3	81.1 ± 0.2	94.5 ± 0.1	99.2 ± 0.1
ResNet-101 ³⁰	42.5 M	0.78 h	59.1 ± 0.4	75.7 ± 0.1	63.6 ± 0.3	80.8 ± 0.1	94.4 ± 0.2	99.2 ± 0.1
ResNet-50 ³⁰	23.5 M	0.55 h	59.1 ± 0.2	75.8 ± 0.1	63.8 ± 0.2	80.9 ± 0.1	94.6 ± 0.1	99.3 ± 0.1

Table 3. The effect of classifier backbone architecture choices on cell-level performances. Every experiment was conducted using NVIDIA RTX 3090 and Intel(R) Core(TM) i9-9900K CPU @ 3.60 GHz.

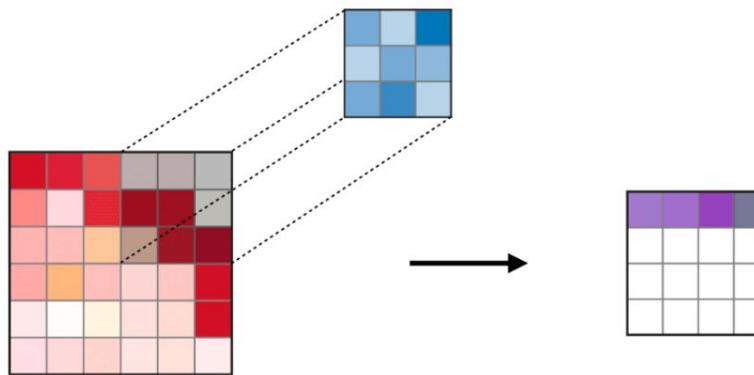


□ **Architecture of a traditional CNN** — Convolutional neural networks, also known as CNNs, are a specific type of neural networks that are generally composed of the following layers:



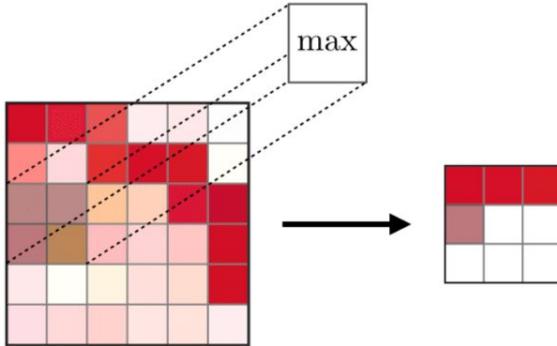
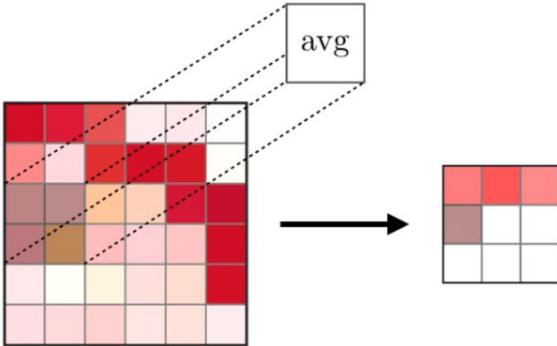
The convolution layer and the pooling layer can be fine-tuned with respect to hyperparameters that are described in the next sections.

□ **Convolution layer (CONV)** — The convolution layer (CONV) uses filters that perform convolution operations as it is scanning the input I with respect to its dimensions. Its hyperparameters include the filter size F and stride S . The resulting output O is called *feature map* or *activation map*.

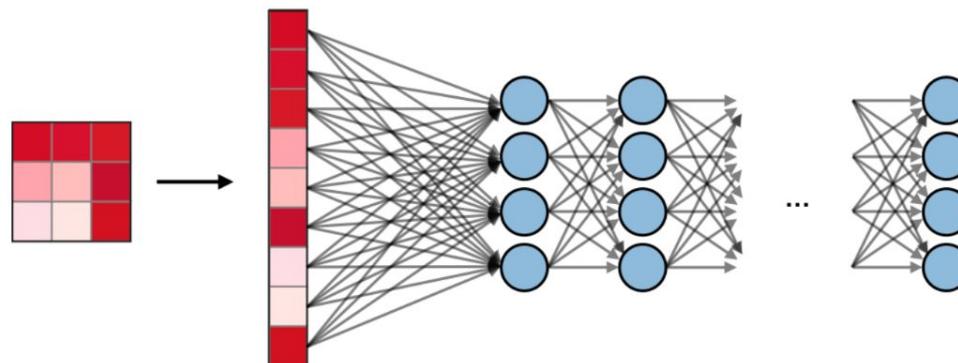


Remark: the convolution step can be generalized to the 1D and 3D cases as well.

□ **Pooling (POOL)** — The pooling layer (POOL) is a downsampling operation, typically applied after a convolution layer, which does some spatial invariance. In particular, max and average pooling are special kinds of pooling where the maximum and average value is taken, respectively.

Type	Max pooling	Average pooling
Purpose	Each pooling operation selects the maximum value of the current view	Each pooling operation averages the values of the current view
Illustration		
Comments	<ul style="list-style-type: none">• Preserves detected features• Most commonly used	<ul style="list-style-type: none">• Downsamples feature map• Used in LeNet

□ **Fully Connected (FC)** — The fully connected layer (FC) operates on a flattened input where each input is connected to all neurons. If present, FC layers are usually found towards the end of CNN architectures and can be used to optimize objectives such as class scores.



Model Reference

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