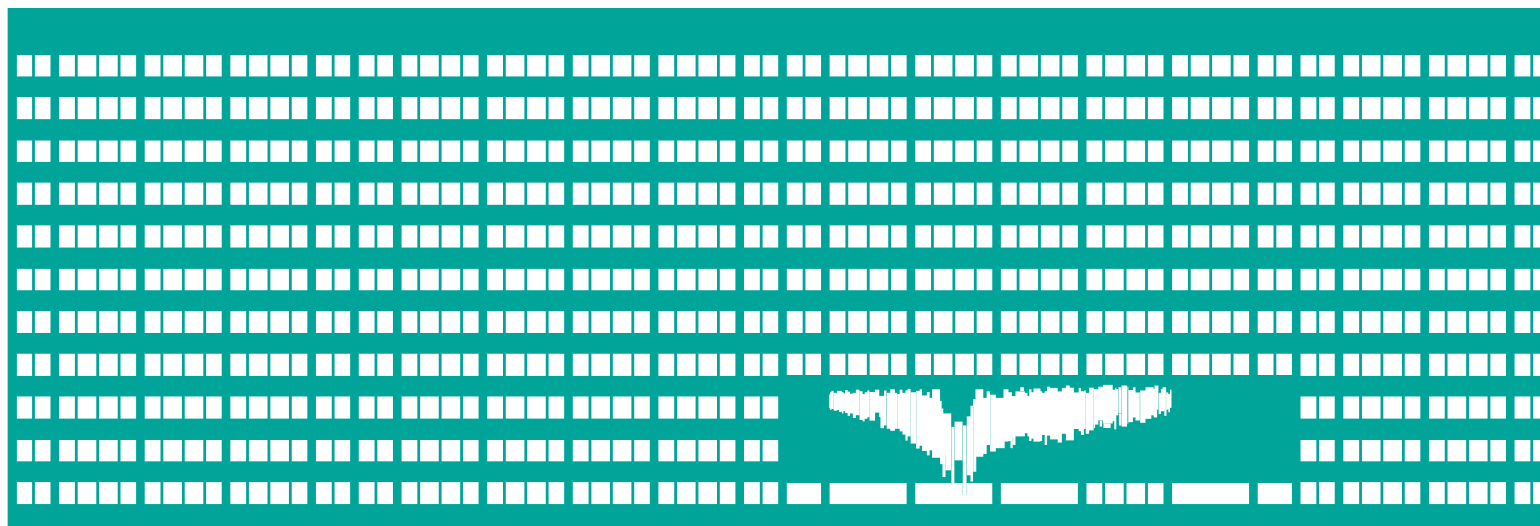




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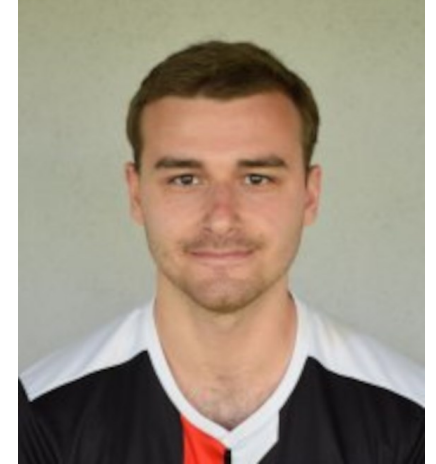
Spatial urban analysis of mobility related phenomena

Jiří Horák, HGF



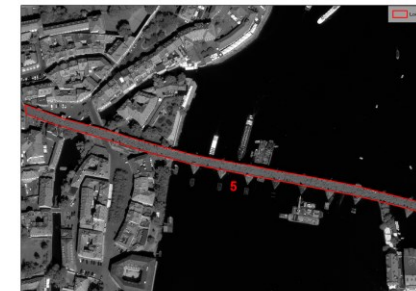
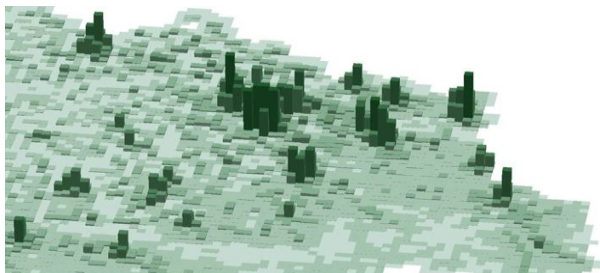
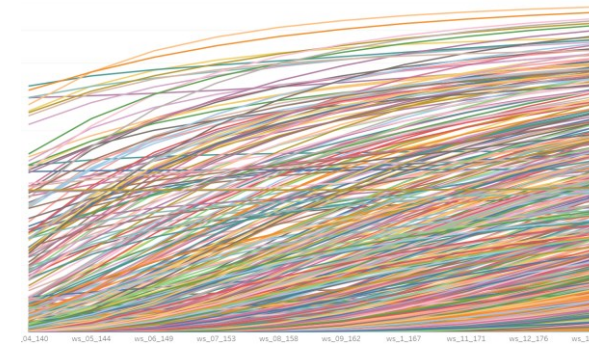
Who We Are

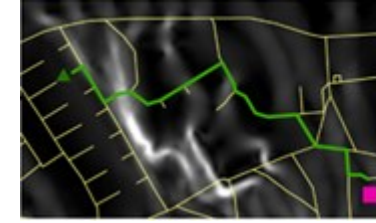
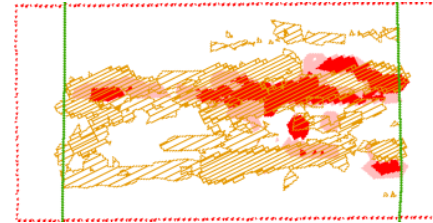
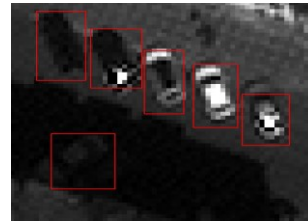
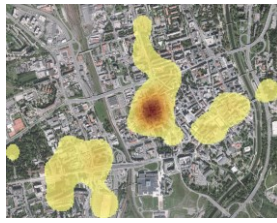
- prof. Jiří Horák, HGF
- Ing. Lucie Orlíková, Ph.D.
- Ing. Pavel Kukuliač, Ph.D.
- Ing. Peter Golej, Ph.D.
- Ph.D. students:
- Ing. Ondřej Kolodziej
- Ing. Martin Zajac
- Mgr. Nikola Koktavá



Research Focus

- Transport accessibility in urban conditions
- Walkability, bikeability, door-to-door, barriers, inclusive city. Adaptation of walkability measures according to various vulnerable groups. Correspondence of perception and objective barrier's measures.
- Public Transport Network vulnerability – detection of critical stops based on network measures
- Spatial Analysis of Social Phenomena such as crime or unemployment.
- Optimization in network analysis (shortest path, TSP, location analysis)
- Geographical analysis of social media messages
- Analysis of satellite images - AI-based image analysis
- Integration of high-resolution optical and radar satellite data for urban and transport applications





Key Results – top publication and citations

1. HORAK J., KUKULIAC P., KOKTAVA N., ORLIKOVA L., MARESOVA P. Impact of street-level barriers on walking accessibility for persons with declining mobility: Comparison of two cities. *Cities* 166 (2025) 106220. <https://doi.org/10.1016/j.cities.2025.106220> **D1**
2. KUKULIAC, P., HORAK, J., FOJTIK, D., KACMARIK, M., KAPICA, R., KREJCAR, O., PODESVA, P., DANDOS, R., JADVIŠČOK, P., MIHOLA, M. (2025). Sidewalk Elevation Barrier Detection Using a 2D LiDAR Scanner. *IEEE Access*, vol. 13, pp. 170993–171008. doi: 10.1109/ACCESS.2025.3615420 . **Q2**
3. GOLEJ P., KUKULIAČ P., HORÁK J., ORLÍKOVÁ L., PARTILA, P. People Detection using Artificial Intelligence with Panchromatic Satellite Images. *Aplied Sciences* (2024), 14(18), 8555, pp. 16 DOI 10.3390/app14188555. **Q2**
4. MARESOVA P., KREJCAR O., MASKURIY R., BAKAR N., SELAMAT A., TRUHLAROVA Z., HORAK J., JOUKL M., VÍTKOVA L. Challenges and opportunity in mobility among older adults – key determinant identification. *BMC Geriatrics*, (2023) 23:447, pp. 1-29. DOI: 10.1186/s12877-023-04106-7. **Q1, 50 citations.**
5. HORAK, J., KUKULIAC, P., MARESOVA, P., ORLIKOVA, L., KOLODZIEJ, P. Spatial Pattern of the Walkability Index, Walk Score and Walk Score Modification for Elderly. *ISPRS Int. J. Geo-Inf.* 2022, 11, 279 (ijgi-1632013); doi: 10.3390/ijgi11050279. **Q2, 20 citations**
6. OSORIO-ARJONA, J., HORAK, J., SVOBODA, R., GARCÍA-RUIZ, Y. Social media semantic perceptions on Madrid Metro system: Using Twitter data to link complaints to space. *Sustainable Cities and Society* 2021, 64, 102530. <https://doi.org/10.1016/j.scs.2020.102530>. **D1, 51 citations**
7. VRABKOVÁ I, ERTINGEROVÁ I, KUKULIAČ P (2021) Determination of gaps in the spatial accessibility of nursing services for persons over the age of 65 with lowered self-sufficiency: Evidence from the Czech Republic. *PLOS ONE* 16(1): e0244991. <https://doi.org/10.1371/journal.pone.0244991>. **Q2, 14 citations**

Key Results – top publication and citations

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Cities
 Volume 166, November 2025, 106220



Impact of street-level barriers on walking accessibility for persons with declining mobility: Comparison of two cities
 Jiri Horak ^a, Pavel Kukuliac ^a, Nikola Kaktava ^a, Lucie Orlikova ^a, Petra Maresova ^b
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 Digital Object Identifier 10.1109/ACCESS.2025.3615420

RESEARCH ARTICLE

Sidewalk Elevation Barrier Detection Using a 2D LiDAR Scanner

PAVEL KUKULIAC¹, JIRI HORAK¹, DAVID FOJTIK², MICHAL KACMARIK¹, (Member, IEEE), ROMAN KAPICA³, ONDREJ KREJCAR⁴, PETR PODESVA², ROSTISLAV DANDOS³, PETR JADVIŠČOK⁵, AND MILAN MIHOLA⁵

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⁴Department of Information Technologies, University of Hradec Králové, 500 03 Hradec Králové, Czech Republic
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Petra Maresova, Ondrej Krejcar , Raihan Maskuriy, Nor Azlina Abu Bakar, Ali Selamat, Zuzana Truhlarova, Jiri Horak, Miroslav Joukl & Lucie Vítková

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Outline

Highlights

Abstract

Keywords

1. Introduction

2. Literature review

3. Study area and data

4. Methodology

5. Results

6. Conclusions

Social media semantic perceptions on Madrid Metro system: Using Twitter data to link complaints to space

Joaquín Osorio-Arjona ^a, Jiri Horak ^{b,1}, Radek Svoboda ^c, Yolanda García-Ruiz ^d

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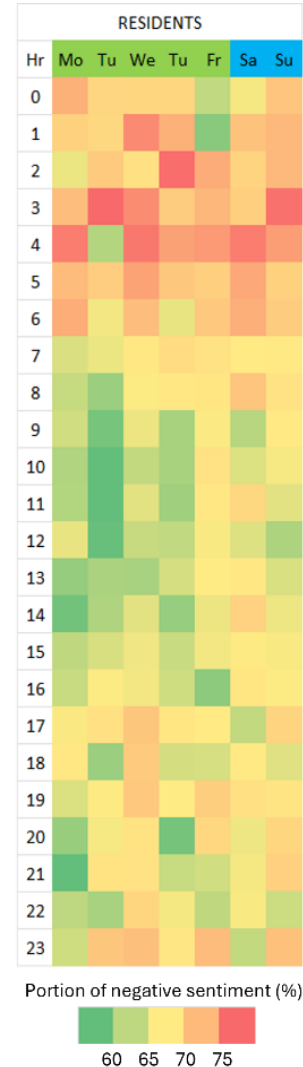
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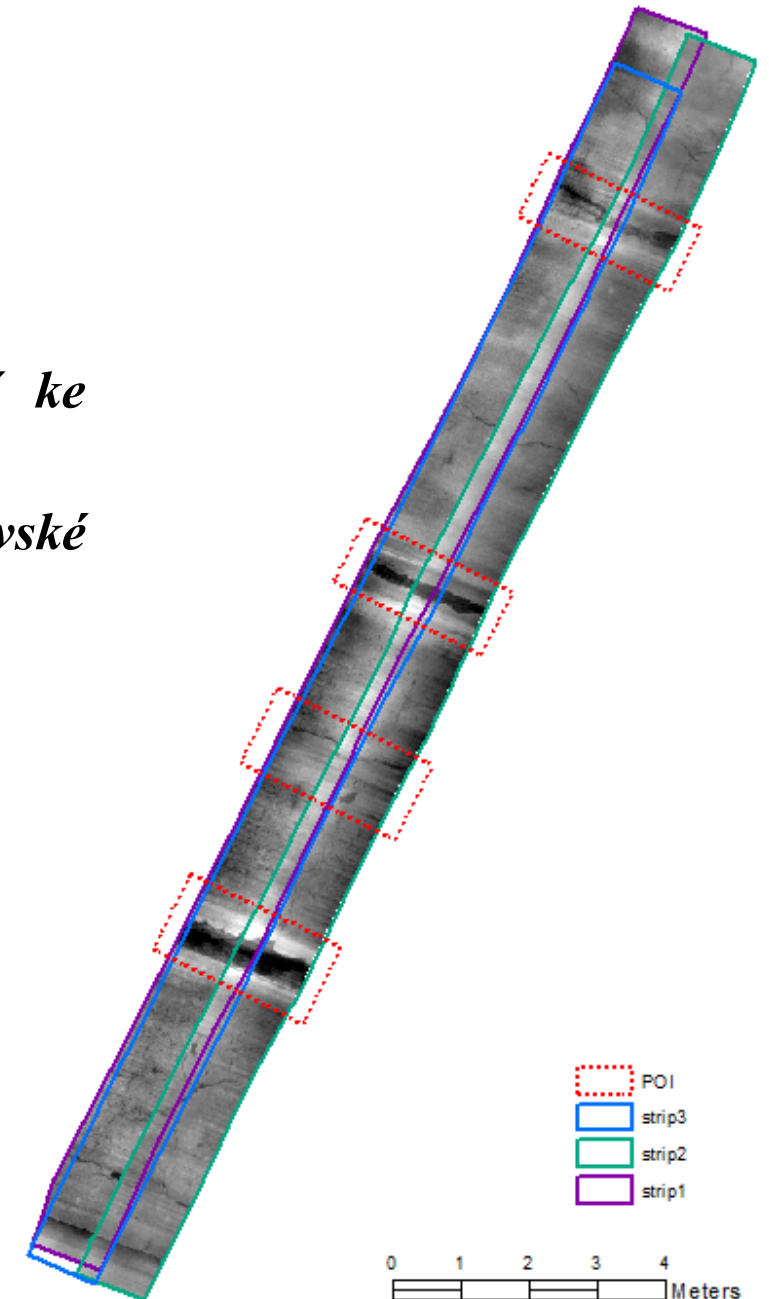
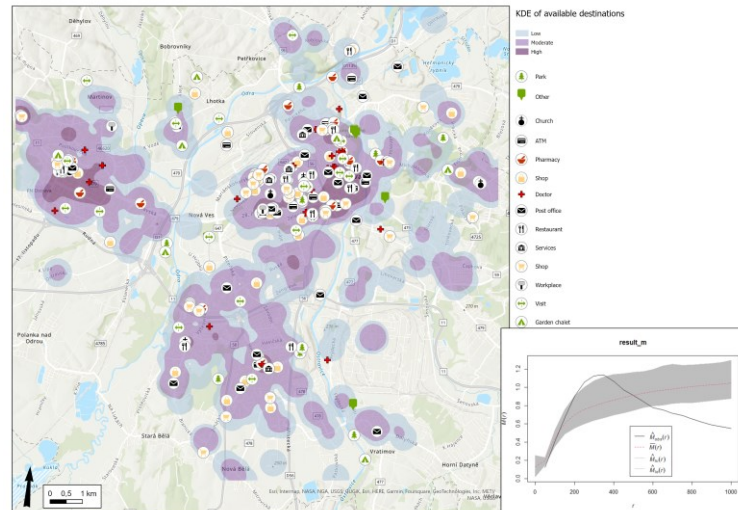
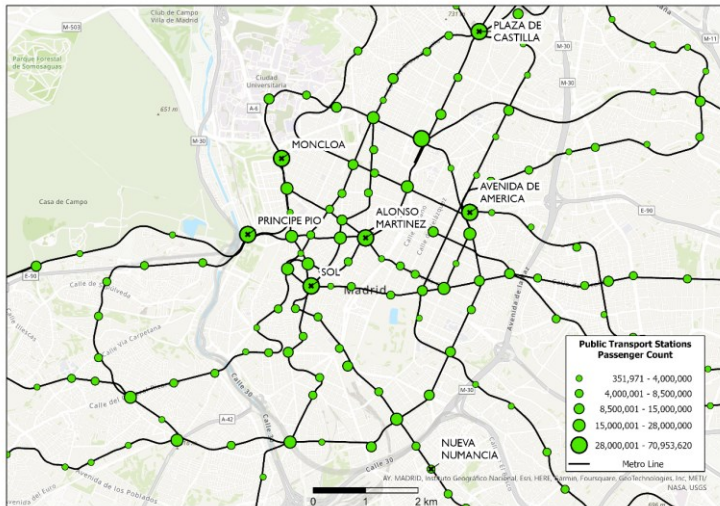
Key Results – projects

1. GAČR *Modelování dostupnosti pro seniory, percepce dostupnosti a determinanty jejich prostorové mobility* 21-22276S (2021-2024)
2. TAČR Doprava2020+ *Senzorové měření pěších komunikací v městském prostředí pro podporu mobility osob se zdravotními omezeními* CK01000190 (2020-2022)
3. TAČR ETA *Metodicko aplikační nástroje pro efektivní finanční řízení územně členěného statutárního města* ETA 1 (STA02018TL010 - TL01000145) (2018-2020).
4. TAČR Zéta *Efektivní metody identifikace, hodnocení a monitoringu bezpečnostně rizikových lokalit s využitím prostorových mikrodat* (2018-2019)
5. GAČR *Prostorové simulační modelování dostupnosti* 14-26831S (2014-2016)
6. GAČR *Industriální město v post-industriální společnosti* GA 403/09/1720 (2005-2007).

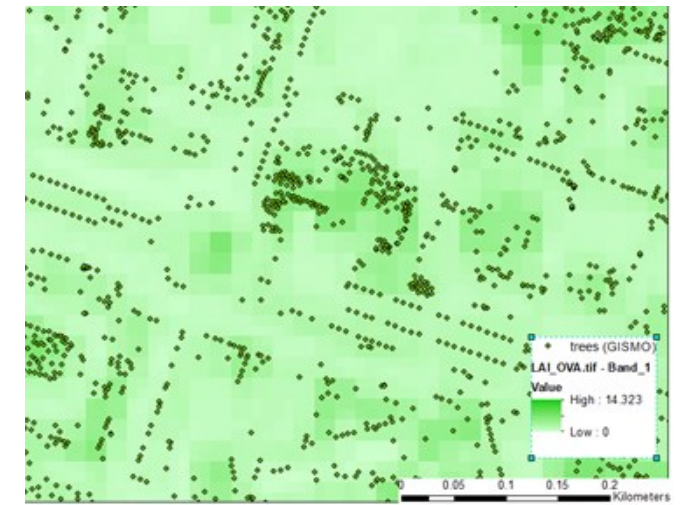


Current Projects

1. TAČR Sigma *Návrh optimalizace sítě středních škol jako opatření ke zmírnění dopadů globálních trendů* TQ23000156 (2025-2027)
2. AJAK *Společenská dimenze nových technologií v energetice v Ostravské metropolitní oblasti* CZ.02.01.01/00/23_021/0008591 (2024-2028)



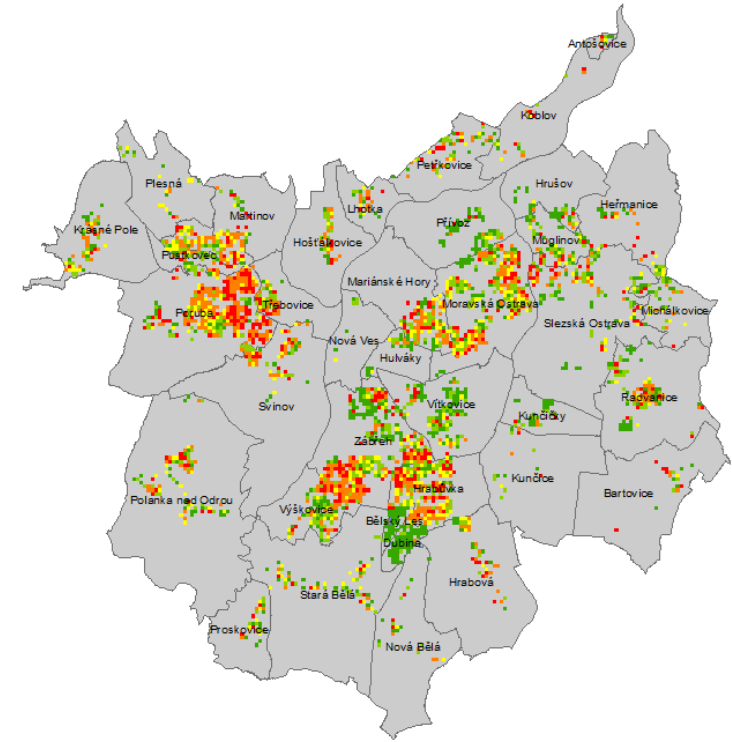
Collaborations



- current partners
- National:
 - Palacky University, Charles University, Czech Technical University, University of Hradec Králové, Prague University of Economics
 - Unicorn, Trexima CZ, Czech Association of Geoinformation, VARS
- International:
 - Institute for Transport Research (Germany), University of Salzburg (Austria), Aalto University (Finland), Technical University of Denmark (DTU), RPTU Kaiserslautern-Landau (Germany), Universidad Nacional de Educación a Distancia (Spain)

Conclusion

- **What we are offering**
 - Comprehensive research in spatial and urban analytics, focusing on mobility, accessibility and inclusiveness of cities
 - Expertise in walkability, bikeability and door-to-door transport accessibility for different social and vulnerable groups
 - Experience in spatial data fusion, combining remote sensing, sensor measurements and socio-economic data for complex modelling
- **What we are looking for**
 - Spatial Machine Learning – including spatial phenomena such as autocorrelation (spatial continuity), spatial stationarity, scale, spatial heterogeneity
 - Collaboration on AI for Earth observation using machine learning for sustainability, energy transition and mobility studies
 - Partnerships with industry



The collage features 18 hexagonal images arranged in a honeycomb pattern. The central hexagon is white and contains the text "VSB TUO" in a teal, sans-serif font, with a logo consisting of four vertical bars of increasing height below it. The surrounding hexagons show various scenes from university life: a man in a blue jacket working on a laptop; a woman in a patterned top looking at a screen; a man in a blue suit speaking; a group of students in a lecture hall; a man in a white shirt smiling; a woman in a green top looking at a screen; a man in a white shirt speaking; a woman in a red top speaking; a man in a blue shirt speaking; a woman in a green top speaking; a man in a blue shirt speaking; a woman in a green top speaking; a man in a blue shirt speaking; a woman in a green top speaking; a man in a blue shirt speaking; a woman in a green top speaking; a man in a blue shirt speaking; a woman in a green top speaking.

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The collage consists of 18 hexagonal images arranged in a circular pattern around a central white hexagon. The images depict various university activities:

- Top left: Three students in a lab setting, one is using a tool on a small object.
- Top center: A woman in a classroom, looking towards the front.
- Top right: A man in a suit speaking, gesturing with his hands.
- Middle left: A large lecture hall with many students seated at desks.
- Middle center: A man in a classroom, looking towards the front.
- Middle right: A woman in a classroom, looking towards the front.
- Bottom left: A man in a classroom, looking towards the front.
- Bottom center: A man in a classroom, looking towards the front.
- Bottom right: A man in a classroom, looking towards the front.

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The collage consists of 18 hexagonal images arranged in a circular pattern around a central white hexagon. The images depict various university activities:

- Top left: Three students in a lab setting, one is using a pipette.
- Top center: A woman in a classroom, looking towards the front.
- Top right: A man in a suit speaking at a podium.
- Middle left: A large lecture hall with many students seated.
- Middle center: A man in a suit speaking at a podium.
- Middle right: A woman in a classroom, looking towards the front.
- Bottom left: A man in a classroom, looking towards the front.
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