WashU Olin Business

MKT 5002: Customer Analytics Spring 2026 (3 Units)

Instructor: Song Yao, Professor of Marketing
Office Hour: By Appointment
Email: songyao@wustl.edu
Homepage: www.songyao.org
For the most up-to-date syllabus, visit https://songyao21.github.io/Public/MKT500T_syllabus_2025SP.pdf

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Course Description and Learning Goals

This course addresses how we use data to learn about and market to individual customers. Using a combination of lectures, labs, and case analyses, we aim to better appreciate the advantages and limitations of data analytics and learn to communicate insights using analytical tools.

The learning objectives of the course are to

(1) Apply different analytic tools to segment and target customers
(2) Intelligently and causally interpret customer data
(3) Use empirical insights to guide managerial decisions.

Prerequisites

The main programming language for this course is Python.[1] Python is one of the industry standard languages for data analytics, visualization, and machine learning. We will have a brief session to refresh your Python knowledge. But if you have never used Python before, it may become a challenge, and please consult with the instructor before the semester starts. Please do not take this class if you are unwilling or unable to make this investment in Python.

Bio

Song Yao is a Professor of Marketing at the Olin Business School, Washington University in St. Louis. He is also an Amazon Scholar and former Principal Economist of Amazon's Stores Economics and Science team (SEAS). His current research interests lie at the intersection of marketing analytics, empirical microeconomics, and machine learning, focusing on pricing, advertising, new technology, and social media. Prior to joining Olin, Professor Yao taught "Digital Marketing," "Customer Analytics," and "Marketing Management" at the University of Minnesota (Carlson), Northwestern University (Kellogg), and Duke University (Fuqua).

Acknowledgements

This course has been shaped and inspired by numerous colleagues, and I'm especially grateful for the mentorship of Professor Florian Zettelmeyer, my former colleague at Northwestern University, who generously shared and co-developed many of the materials used in this course. Additionally, the causal inference topics in this course draw on insights from two excellent resources: *Causal Inference: The Mixtape* by Scott Cunningham, and *Causal Inference in Python: Applying Causal Inference in the Tech Industry* by Matheus Facure.

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[1] This course was taught in R in the past few years, and we will experiment with Python for the first time. Furthermore, the instructor will introduce new content throughout the semester. Accordingly, the syllabus may be subject to change. For the most up-to-date syllabus throughout the semester, visit https://songyao21.github.io/Public/MKT500T_syllabus_2025SP.pdf.

Course Schedule and Assignment Due Dates

(Section 01 and Section 02 Tuesday/Thursday)

Date	Class #	Class Title	Assignments Due (Ind.=Individual-based; Grp.=Group-based)
January 14	1	Customer Analytics Overview; Quantifying Customer Value	
January 16	2	Using Python for Basic Customer Analysis; How to Tell Good Analytics from Bad Analytics	
January 21	3	Case Analysis: "Home Alarm, Inc.: Assessing Customer Lifetime Value," A/B Test, and Beyond	**Home Alarm LTV (Ind.)**
January 23	4	Statistics Review	
January 28	5	Predicting Response with RFM Analysis	**Using Python for Basic Customer Analysis (Ind.)**
January 30	6	Directed Acyclic Graph (DAG)	
February 4	7	Case Analysis: "Tuango: RFM Analysis for Mobile App Push Messaging"; Lift and Gains	**Tuango RFM (Ind.)**
February 6	8	Linear Regressions and its applications; Interpreting Interaction Effects; Diff-in-Diff Regression	**Using DAG for Bias Diagnosis (Ind.)**
February 11	9	Predicting Response with Logistic Regression	
February 13	10	Case Analysis: "Diff-in-Diff Analysis"; K-means and segmentation	**Diff-in-Diff Analysis (Ind.)**
February 18	11	Predicting Binary Response with Neural Networks	
February 20	12	Case Analysis: "BookBinders: Predicting Response with Logistic Regression"	**BookBinder Logistic Regression (Ind.)**
February 25		***No class***	
February 27		**In-class Midterm**	
March 18	13	Cross-selling and Upselling: Learning from Purchases	
March 20	14	Predicting Binary Response with Decision Tree	
March 25	15	Case Analysis: "Pentathlon: Cross-selling/Upselling;" Predicting Attrition	**Pentathlon: Cross-selling/Upselling (Grp.)**
March 27	16	Matching	
April 1	17	Case Analysis: "V-Mobile: Churn Management;" From Prediction to Prescription	**V-Mobile: Churn Management (Grp.)**
April 3	18	***Videos of matching codes; No In-person Class***	
April 8	19	Synthetic Control Method	**V-Mobile: Causal Analysis using Matching (Grp.)**
April 10	20	Instrumental Variable	
April 15	21	Recommendation Overview	
April 17	22	Synthetic Diff-in-Diff	**Synthetic Control (Grp.)**
April 22	23	Double Machine Learning (DML)	
April 24	24	Course Wrap-up	**Instrumental Variable Estimation (Grp.)**

Grading policy and assignments

The final grade of this course will be based on the following weights for each evaluation element:

		Grading Scale:	
Midterm	15%	90-100	A
Participation and Peer Review	10%	80-89	B
Individual-based assignments (6)	35% (5%, 4%, 7%, 4%, 7%, 8%)	70-79	C
Group-based assignments (4 or 5)	40% (10% or 8% per assignment)	60-69	D
		59-Below	F

Late Assignment

Please note that the deadlines for all assignments are **1PM on the due days (NOT the starting time of each individual session)**. Without pre-approval from the instructor,

- Late submissions within one day (i.e., by 1PM the next day) are penalized by 1/5 of the total points (e.g., the highest score of a late submission is 4pts for a 5pts assignment even if you have all the correct answers). Your final assignment score will be scaled proportionately (e.g., if you submitted your assignment late and scored 4 out of 5 based on your answers, your final score for the assignment would be 3.2).
- Late submission after 1PM of the next day of the deadline, I reserve the right to give 0 point for that assignment unless there is evidence of special circumstances.

Class participation
Quality contributions that are relevant to the discussion will improve your participation grade. I will call on students at random to answer questions and open discussions. Your participation grade will be significantly hurt if you are called upon to offer your analysis on an assignment question and you are not prepared.

A peer review form will be distributed at the end of the semester. Your contribution to the team will be 50% of your class participation score (i.e., 5% of the total course grade). Please complete this evaluation form on time. **Failing to turn it in by the deadline will result in an automatic deduction of the 5% from your total course grade.**

Attendance and punctuality
Learning to articulate your analysis and to evaluate and respond to the analysis of others is an important part of what you will learn in this class. You should make every effort to participate each class in person. **If you miss class or are late more than twice without reasonable justifications, it will lower your class participation grade.** If you must miss class for any reason, please inform me in advance. And you should prepare and turn in the assignments on time (see above for late assignments policy). If you miss 4 or more classes, I reserve the right to fail you.

Individual and group exercises
Much of the learning during the course will happen with the help of individual and group assignments. These assignments are described in detail in the syllabus. If an exercise is labeled an "individual exercise," you are not allowed to work with other students--the write-up should reflect your own work only. If an exercise is labeled a "group exercise," you should work on it in groups and only hand in one write-up per group (4-5 students). Groups should be formed (self-selected) within the same section and remain constant throughout the semester. The group information is due by the Friday of Week 5.

It violates academic integrity if you base your assignments on solutions you have found online or obtained from students in prior years. I reserve the right to fail you for the course if I become aware of such a violation.

Specific rules about assignments and midterm
- You can talk (verbally) to classmates about assignments.
- For individual assignments, you cannot share your write-ups and codes with other students through any methods, both online and offline.
- For group assignments, you cannot share your write-ups and codes with other students beyond your group through any methods, both online and offline.
- For the midterm, you cannot discuss or share questions and answers with students beyond your section before 5:30PM on the day of the exam, both online and offline.
- I do not restrict your usage of AI tools (e.g., ChatGPT) because, in my opinion, there are no effective reinforcement tools for restricting the usage. Furthermore, AI tools have become more widely adopted by academia and industry. However, it is your responsibility to ensure the accuracy and relevance of your answers. Checking the AI-generated content for accuracy can also help you better understand course materials. If the TAs or I identify instances where AI tools have been used to generate irrelevant or incorrect answers, we reserve the right to assign a score of 0 for that assignment. To avoid this, I strongly encourage you to carefully evaluate AI responses, supplement them with your own analysis and thinking. Remember, AI tools should be a supplement rather than a substitute for your effort or critical thinking.

Copyrights of Course Materials

- Course materials (including but not limited to slides, assignments, codes) are copyrighted. Students should never post or share course materials online.

University-Wide Guidelines & Policies

Reporting Sexual Assault and Harassment
If a student discusses or discloses an instance of sexual assault, sex discrimination, sexual harassment, dating violence, domestic violence or stalking, or if a faculty member otherwise observes or becomes aware of such an allegation, the faculty member will keep the information as private as possible they are required to immediately report it to the Department Chair or Dean or directly to the Gender Equity and Title IX Compliance Office at (314) 935-3393 or titleix@wustl.edu. They will also offer available resources, including confidential support resources through the Relationship and Sexual Violence Prevention (RSVP) at 314-935-3445. Additionally, you can report incidents or complaints to the Office of Student Conduct and Community Standards or by contacting WUPD at (314) 935-5555 or your local law enforcement agency. See: Gender Equity and Title IX Compliance Office

Disability Resources (DR)
WashU supports the right of all enrolled students to an equitable educational opportunity and strives to create an inclusive learning environment. In the event the physical or online environment results in barriers to the inclusion of a student due to a disability, they should notify the instructor as soon as possible.

Disabled students requiring adjustments to equitably complete expectations in this course should contact WashU's Disability Resources (DR) and engage in a process for determining and communicating reasonable accommodations. Because accommodations are not applied retroactively, DR recommends initiating requests prior to, or at the beginning of, the academic term to avoid delays in accessing accommodations once classes begin. Once established, responsibility for disability-related accommodations and access is shared by Disability Resources, faculty, and the student.
Disability Resources: www.disability.wustl.edu; 314-935-5970

Statement on Military Service Leave
WashU recognizes that students serving in the U.S. Armed Forces and their family members may encounter situations where military service forces them to withdraw from a course of study, sometimes with little notice.

Students may contact the Office of Military and Veteran Services at (314) 935-2609 or veterans@wustl.edu and their academic dean for guidance and assistance. See: https://veterans.wustl.edu/policies/policy-for-military-students/.

Preferred Name and Personal Pronouns

WashU recognizes that many students prefer to use names other than their legal ones to identify themselves. In addition, in order to affirm each person's gender identity and lived experiences, it is important that we ask and check in with others about pronouns. This simple effort can make a profound difference in a person's experience of safety, respect, and support. See: Pronouns Information and Preferred Name.

Emergency Preparedness

Before an emergency, familiarize yourself with the building(s) that you frequent. Know the layout, including exit locations, stairwells and the Emergency Assembly Point (EAP). Review the "Quick Guide for Emergencies" that is found near the door in many classrooms and main lobby areas of buildings for specific emergency information and instructions. For additional Information and EAP maps, visit https://emergency.wustl.edu/. To ensure that you receive emergency notifications, make sure your information and cell phone number is updated in SIS, and/or download the WashU Safe app and enable notifications.

To report an emergency:
Danforth Campus: (314) 935-5555
School of Medicine Campus: (314) 362-4357
North/West/South and Off Campus: 911 then (314) 935-5555

Academic Integrity

Effective learning, teaching and research all depend upon the ability of members of the academic community to trust one another and to trust the integrity of work that is submitted for academic credit or conducted in the wider arena of scholarly research. Such an atmosphere of mutual trust fosters the free exchange of ideas and enables all members of the community to achieve their highest potential.

In all academic work, the ideas and contributions of others (including generative artificial intelligence) must be appropriately acknowledged and work that is presented as original must be, in fact, original. Faculty, students and administrative staff all share the responsibility of ensuring the honesty and fairness of the intellectual environment at WashU.

For additional details on the university-wide Undergraduate Academic Integrity policy, please see: https://wustl.edu/about/compliance-policies/academic-policies/undergraduate-student-academic- integrity-policy/

Academic integrity is a serious offense that may lead to warning, probation, suspension, or expulsion from the University. All instances of academic integrity allegations will be reported to Academic Integrity in the Office of the Provost, who will hold an initial meeting and then determine next steps with the student. For more information on the academic integrity policy, procedures, frequently asked questions, and who to contact, visit Academic Integrity in the Office of the Provost. The academic integrity policy, process, and information listed there applies to undergraduate students enrolled in all Schools and programs and master's level students in the McKelvey School of Engineering, the Sam Fox School of Design and Visual Arts, and the School of Continuing and Professional Studies. For all other programs, please see the Contacts page.

In all cases of academic integrity violations, the instructor shall make an academic judgment about the student's grade on that work and in that course, which shall not be considered a sanction for prohibited conduct under this policy.

*(*Note Instructors are encouraged to include in their syllabus a link to information on Academic Integrity policies and procedures. You are also encouraged to cover this information with your students and provide examples of what is permissible and what are the more common violations in your subject area.)*

Turnitin *(*Note that this should be included if you might use TurnItIn in your course at any point)*
In taking this course, students may be expected to submit papers and assignments through Turnitin for detection of potential plagiarism and other academic integrity concerns. If students do not have an account with Turnitin and/or

do not utilize Turnitin when submitting their papers and assignments, the instructor may upload your paper or assignment to Turnitin for processing and review.

Religious Holidays

As home to students, faculty, and staff of all the world's major religions and as a non-sectarian institution, WashU values the rich diversity of spiritual expression and practice found on campus. It is therefore the policy of the university that students who miss class, assignments, or exams to observe a religious holiday should be accommodated. To ensure that accommodations may be made, students who plan to miss class for a religious holiday must inform their instructors in writing before the end of the third week of class, or as soon as possible if the holiday occurs during the first three weeks of the semester. Instructors should inform students on their syllabus and/or at the start of the class how they would like students to notify them of any accommodation needs related to religious observance. The university's Religious Holiday Class Absence Policy can be found here.

The Office of Religious, Spiritual and Ethical Life maintains a calendar of many religious holidays observed by the WashU community.

See the end of document for dates of some religious holidays or obligations that may pose potential conflicts for observant students.

Unauthorized Recording and Distribution of Classroom Activities and Course Materials

Except as otherwise expressly authorized by the instructor or the university, students may not record, stream, reproduce, display, publish or further distribute any classroom activities or course materials. This includes lectures, class discussions, advising meetings, office hours, assessments, problems, answers, presentations, slides, screenshots or other materials presented as part of the course. If a student with a disability wishes to request the use of assistive technology as a reasonable accommodation, the student must first contact the Office of Disability Resources to seek approval. If recording is permitted, unauthorized use or distribution of recordings is also prohibited.

COVID-19 Health and Safety Protocols

Students experiencing symptoms consistent with COVID-19 or concerned about a possible exposure should contact the Student Health Center (314 935-6666) to arrange for testing as indicated. If a student tests positive for Covid-19, they will receive a letter with instructions about any necessary isolation that they can share with their instructors. Any accommodation needs for COVID-related absence not covered in an instructor's standard course policies should be discussed between the student and instructor.

** During periods of high transmission, it may not be feasible for all students to receive documentation from SHC. In these instances, please extend grace to students who indicate a need to isolate and allow their absence so that we may reduce the likelihood of illnesses being transmitted in our classrooms.

While on campus, it is imperative that students follow all public health guidelines established to reduce the risk of COVID-19 transmission within our community.

Masking: Masking remains a valuable tool in the mitigation of COVID-19, and all respiratory illnesses. Students and instructors are encouraged to treat requests to mask with care and consideration, keeping in mind that some individuals may be at a higher risk, caring for others at a higher risk, or feeling less comfortable in a mask-optional environment. Based on monitoring of regional and campus conditions, a mask requirement may be implemented as needed.

Students with disabilities for whom masked instructors or classmates create a communication barrier are encouraged to contact Disability Resources (www.disability.wustl.edu) or talk to their instructor for assistance in determining reasonable adjustments. Adjustments may involve amplification devices, captioning, or clear masks but will not allow for the disregard of mask policies should a requirement be in place.

Resources for Students

Confidential Resources for Incidents of Sexual Assault, Sex Discrimination, Sexual Harassment, Dating Violence, Domestic Violence, or Stalking

WashU is committed to offering reasonable academic supportive measures (e.g. a no-contact order, course changes) to students who are victims of relationship or sexual violence, regardless of whether they seek a formal investigation or criminal charges. If a student needs to explore options for medical care, other services, or reporting, or would like to receive individual counseling services, there are free, confidential support resources and professional counseling services available through the Relationship and Sexual Violence Prevention (RSVP) Center. If you need to request such support, please contact RSVP to schedule an appointment with a confidential and licensed counselor. Although information shared with counselors is confidential, requests for supportive measures will be coordinated with the appropriate University administrators and faculty. The RSVP Center is located in Seigle Hall, Suite 435, and can be reached at rsvpcenter@wustl.edu or (314) 935-3445. For after-hours emergency response services, call the Sexual Assault and Rape Anonymous Helpline (SARAH) at (314) 935-8080 during the academic year, or (314) 935-5555 and ask to speak with an RSVP Center Counselor on call. See: RSVP Center.

Bias Reporting and Support System (BRSS)

WashU has a non-punitive process through which students, faculty, staff, and community members who have experienced or witnessed incidents of bias, prejudice, or discrimination against a student can report their experiences to the University's Bias Report and Support System (BRSS) team.

Center for Career Engagement (CCE)

The Center for Career Engagement provides one-on-one coaching, resources, programs and events to support the lifelong career success of all students and alumni. In addition to having your resume reviewed or fine-tuning your interviewing skills, the CCE invites you to work with us as partners at every stage of your career development as you reflect, learn and experiment. Our Certified Career Management Coaches will listen, ask questions, and provide resources to help you understand yourself, envision possibilities, prepare, search and apply, and engage in your career development.

You can select a career coach based on availability and alignment with one of our industry-aligned career communities or you can choose a coach in the Career Exploration community.

To make an in-person or virtual appointment:
1. Log in to Handshake

2. Click Career Center (left side tool bar)
3. Click Appointments.

The CCE is conveniently located in the Danforth University Center, Suite 110 with several additional office spaces across campus in Knight Hall 210, Bauer Hall 250, Steinberg Hall and Brown Hall.

Counseling and Psychological Services

The Center for Counseling and Psychological Services' professional staff members work with students to resolve personal and interpersonal difficulties, many of which can affect a student's academic experience. These include conflicts with or worry about friends or family, concerns about eating or drinking patterns, and feelings of anxiety, depression, and thoughts of suicide. Individual, Conjoint, and Group therapy are all provided in addition to referrals for off-campus support. Information can be found on the CCPS webpage.

The Division of Student Affairs also offers a telehealth program to students called TimelyCare. While students are encouraged to visit CCPS during business hours, this additional service also provides after-hours access to medical care and 24/7 access to mental telehealth care across the United States, with no cost at the time of the

visit. 12 counseling visits are provided at no charge as well as a limited number of psychiatry appointments. Students who pay the Health and Wellness fee are eligible for this service.

Additionally, see the mental health services offered through the RSVP Center.

WashU Cares

WashU Cares specializes providing referrals and resources, both on, and off campus for mental health, medical health, financial and academic resources by using supportive case management. WashU Cares also receives reports on students who may need help connecting to resources or whom a campus partner is concerned about. If you are concerned about a student or yourself, you can file a report here: https://carestream.washu.edu.

The Writing Center

The Writing Center offers free writing support to all WashU undergraduate and graduate students. Staff members will work with students on any kind of writing project, including essays, writing assignments, personal statements, theses, and dissertations. They can help at any stage of the process, including brainstorming, developing and clarifying an argument, organizing evidence, or improving style. Instead of simply editing or proofreading papers, the tutors will ask questions and have a conversation with the writer about their ideas and reasoning, allowing for a higher order revision of the work. They will also spend some time looking at sentence level patterns to teach students to edit their own work.

The Center is located in Mallinckrodt, and appointments are available days and evenings Sunday through Friday. Office staff hours are Monday through Friday 10:00am to 4:00pm. Students are seen primarily by appointment, with walk-ins accepted as the schedule allows. They also have dedicated walk-in hours for undergraduates on Tuesday and Wednesday afternoons. Both in-person and online appointments are available. To make an appointment, go to writingcenter.wustl.edu. Email: writing@wustl.edu.

The Learning Center

The Learning Center provides peer-led support programs, including course-specific mentoring and academic skills coaching (study and test-taking strategies, time management, etc.), that enhance undergraduate students' academic progress. Contact them at learningcenter@wustl.edu or visit ctl.wustl.edu/learningcenter to find out what support they may offer for your classes.

Center for Diversity and Inclusion (CDI)

The Center for Diversity and Inclusion (CDI) supports and advocates for all undergraduate, graduate, and professional school students. We foster belonging for all! Visit our website for more information and resources. The CDI consists of the following offices and is physically located in the Danforth University Center (DUC) Suite 150 and the Women's Building Room 102.

- Cross-Cultural Connections (CCxN) – DUC 150
- Office for International Student Engagement (OISE) – Women's Building 102
- Office for Religious, Spiritual and Ethical Life (ORSEL) – DUC 150
- Spectrum Office (LGBTQIA+ Support) – DUC 150

The Dialogue Across Difference (DxD) program at WashU prepares students to engage in dialogue across perspectives. Students use dialogue to understand each other and see differences as learning opportunities. DxD offers 1 credit 8-week dialogue courses for undergraduate students and workshops and programs open to all graduate, undergraduate, and professional students. Visit us in DUC 340 or our website to learn more about DxD

Gephardt Institute

Students play an essential role in a vibrant and functioning democracy. State and local elections take place throughout the year and have a direct impact on our communities. Visit vote411.org to find dates and details of upcoming elections in every state. You can register to vote, request an absentee ballot, confirm your polling location, and get Election Day reminders at http://wustl.turbovote.org for any of the 50 states and Washington D.C. WashU students are considered Missouri residents, and eligible student voters can register to vote in the state of Missouri or their home state. You need to update your voter registration every time you move, even within the same city.

Whether or not you're eligible to vote, you can participate by encouraging your friends to register and vote, engaging your peers in local issues, and taking part in other civic and community engagement activities. For more

resources on voting and other civic and community engagement opportunities, including Civic Action Week, please visit http://washuvotes.washu.edu and http://gephardtinstitute.washu.edu.

<h2 style="text-align:center">University Libraries</h2>

WashU Libraries include seven unique locations across the Danforth Campus, but they are much more than just beautiful, quiet spaces for studying and group work. The Libraries include librarians for every discipline on campus, with the expertise to work with you to develop research ideas and find the best resources to meet your needs; you are also encouraged to explore our research guides, tailored for each subject and available online. The Libraries hold over five million items in the collections—print books, journals, electronic resources, databases, and millions more accessible through interlibrary loan—and you can find it all at the search on our home page. Additional resources for students include special collections, data services, citation help, digital publishing, and more. Visit the Libraries website for more details about these and other ways that the Libraries are here to support your academic success.